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THE
INFLUENCE OF HEREDITY AND CONTAGION
ON THE
PROPAGATION OF TUBERCULOSIS,
AND THE
PREVENTION OF INJURIOUS EFFECTS FROM
CONSUMPTION OF THE FLESH AND MILK
OF TUBERCULOUS ANIMALS.

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THIS Report was prepared for discussion at the International Veterinary Congress held at Brussels in September, 1883, the Commission charged with the duty of preparing it being Monsieur Van Hertsen, Chief Inspector of the Brussels Abattoir; Dr. Fleming, Principal Veterinary Surgeon to the British Army; and Herr Lydtin, Principal Veterinary Surgeon of the Grand Duchy of Baden, who acted as reporter.

The immense importance of the subject, from a sanitary and pecuniary point of view, has induced me to offer a translation of the Report, and the discussion thereon.

GEORGE FLEMING.

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THE ideas we may entertain as to the nature of things are far from being immutable, but are being incessantly modified under the influence of the progress daily made in human knowledge, and more especially since the introduction into scientific studies of new methods and new means of analysis and research. The history of natural sciences in general, and that of the two medicines in particular, furnishes us with an evident proof of this fact.

Objects and processes of which beforetimes the existence could only be suspected, or the salient characteristics of which were only vaguely known, are now very often presented to us in a form very much more definite and precise, because intelligent workers have made them subjects of special research ; and very frequently, also, this new conception of things and of facts has been recognised as erroneous when mechanical, physical, and chemical investigation have been applied to their analyses.

After having submitted to these modifications—which were the necessary consequences of the facts unveiled by observation, as well as by chemical, physical, and mechanical analyses—the dominant ideas in medicine underwent a new and profound transformation when, under the impulsion of Bacon, the illustrious reformer of modern science, the methods of experimental research, which have only been recently accepted and introduced into medicine, were applied to scientific studies.

Physical, chemical, anatomical, and microscopical analyses, in revealing the nature of the primary figured elements, as well

as the amorphous constituents of the different tissues, have given to the physician a power of discernment which he could not have attained so long as in his researches he was limited to unaided eye observations and comparative studies. By the new analytical methods he has acquired such an intimate knowledge of vital processes and their consequences, that he is enabled to differentiate the various morbid conditions and phenomena which, until recently, he had considered as similar or identical.

The experimental method adopted completes these various kinds of medical analyses, and permits us to discover that even in things and processes which, until recently, were confounded with each other, there yet exist notable differences.

To these different means of investigation, which have effected so much in medical progress, is to be added the knowledge, more recently acquired, of the infinitely minute organisms, and the influence they exercise on the processes occurring in the organic world. The discoveries relative to these microscopic beings and their mode of life, have made known the causes of many phenomena hitherto inexplicable, and permitted a clear distinction to be made between things before undistinguishable.

Finally, statistical studies have, in their turn, exhibited the extent to which diseases prevail in different countries, together with their degree of persistency, as well as sometimes indicating the modes of propagation of those causes to which these maladies are due.

How many diseases, essentially distinct, were confounded with each other at a time when examination of the sick only allowed the physician to recognise the disturbances easily noted by the ordinary means of investigation? The time has not long gone by when we exclusively sought in the seat, the dryness or humidity of the diseased surface, and the course and termination of the affection, the bases of every classification of dermatoses; and cases are well within memory in which simple cutaneous affections were supposed to be due to, or allied with, internal diseases, though more or less modified in their course by the action of certain kinds of treatment; and it is not so long since the cutaneous localisations of an internal malady were mistaken for veritable dermatoses.

The minute study of the skin and its histological characters, has brought about a classification of dermatoses conformable to the demands of science ; but it is only by a detailed study of the parasitic organisms that we are enabled to assign to certain among them the place to which they really belong in the nosologic list, and to determine the means by which we may rationally combat them.

Our knowledge with regard to diseases of the respiratory apparatus in general, and those of the domesticated animals in particular, left at other times as much to be desired as we have now acquired with respect to the affections of the skin. So it was that we kept apart, in classification, the diseases accompanied by discharge from the nasal cavities and those in which this feature was absent ; and so it was that we confounded simple Rhinitis with Strangles (*Adenitis equorum*), disease of the frontal sinuses, dental fistulæ, catarrh of the trachea and bronchi, and that we classed it in the same group with these maladies, because of symptoms which were only the consequence of certain pulmonary affections, and others which were only the expression of Glanders accompanied by nasal discharge. This confusion was maintained until the moment when anatomo-pathological knowledge began to reveal the differential characters of these disorders.

The anatomical, histological, and experimental methods have not only led to the differentiation of diseases which were hitherto confounded, or at least considered as similar to each other, but they have also shown that the same malady may manifest itself in different forms—forms which previously were supposed to indicate distinct diseases. As an instance of this, we have only to allude to Glanders and Farcy, which not very long ago were looked upon, in general, as distinct maladies, notwithstanding the advice of certain observant and experienced minds, who had already suspected at least the similitude or identity of the two conditions. This identity, nevertheless, has only been established in a positive manner since recourse has been had to anatomo-pathological researches and to experimentation. These researches have, in addition, led to the knowledge of morbid troubles which had previously remained unperceived or unex-

plained. While, beforetimes, the only typical manifestations of Glanders were the ulcers, "buttons," or tumours, as well as the tumefaction of vessels and lymphatic glands—to which were superadded, at a later period, pulmonary nodules—it is now recognised that the conjunctival cicatrices, and the glanderous and pneumonic lobular vegetations, may also be independent and primary manifestations of Glander infection.

Until serious anatomo-pathological researches were introduced into medicine, it was believed that glanderous lesions could only be found in the respiratory organs, in the lymphatic vessels, and in the skin ; but since then, and especially since recourse has been had to experimental investigations, it has been recognised that the lesions of the disease may be as fully developed in any other living tissue, even the bones not being exempt.

It was not without much surprise that clinicians were convinced that, in order to diagnose a glanderous disease, it was necessary to do more than merely examine the nasal cavities, the larynx, and the skin and subcutaneous tissue ; and that in addition to Glanders localised in the nasal cavities and the larynx, there was Glanders of the viscera, and even of the bones.

The discovery of the different forms Glanders assumes, explains how it was that for centuries the non-contagiousness of this malady was maintained, notwithstanding the numerous experiments instituted with a view to establish its transmissibility. It is only since the different manifestations of Glanders were recognised, that veterinary surgeons, who were sanitarians, could provide the Legislature with more exact information as to the cause of this malady, and to prescribe the measures necessary to successfully combat farcino-glanderous affections.

The history of Tuberculosis, which is the subject of this work, resembles that of Glanders, especially in regard to the successive phases of that malady, the contradictory discussions arising as to its contagiousness, as to the identity of Glanders and Farcy, occult Glanders—latent or concealed—as well as the notable divergence of opinion with respect to the measures required to limit the propagation of this disease. The similarity in these two histories is all the more marked, when it is remembered that it was only at the commencement of this century that a physician

of the French army, M. Lorin, had positively recognised the transmissibility of Glanders to man (zooanthroponosis), and that it is only since then that we are in possession of serious arguments in favour of the identity of Pulmonary Phthisis and Tuberculosis in the human species.

The disease which now occupies our attention is usually designated (on the Continent) Tuberculous Phthisis, or bovine Tuberculosis; though it is well known by a number of other names which reflect more or less the ideas prevailing at different periods, relative to the character of this affection, the extension of which is considerable, and the nature of which is still more or less unknown.

Animals affected with this disease have cough, and are generally emaciated. On opening their carcase, nodules are usually found in the lungs, either ulcerated or containing pus. As these lesions and symptoms are among those most frequently met with in the bodies of animals attacked by this disease, they have been the first to attract attention; and it is also probable that, for this reason, the old and popular names for this affection are Phthisis (Pining, Consumption, *English*; Schwinden, Schwindsucht, *German*; Phtisie, *French*), Cough, pulmonary ulceration (Wasting of the lungs, Lungen Schwärung).

Moses already appears to have referred to this disease (Leviticus, chap. xxii. verse 8 *et seq.*); and Columella, in his *De re Rustica* (cap. xiv. lib. vi.), designates it under the name of "exulceratio pulmonis," the reference being as follows: "Ad exulcerationem pulmonis et ad tumorem palati atque cervicis; Est etiam illa gravis pernicies, cum *pulmones exulcerantur*, inde tussis et macies et ad ultimum *phthisis* invadit." The French expression, Phtisie pommelière, is no doubt derived from the same origin, as are also the German designations of "Lungensucht," and "Lungenfæule."

Keeping in mind the exaggeration in the venereal sensations (both with regard to their persistency and their intensity), so often observed in animals affected with this disease, it has also received such names as Nymphomania, Satyriasis (Latin), Satyriasis stiersucht, geile sucht, Monatseiteri (German), Ninfomanio, Furore uterino (Italian), Brummel (Swiss), Bulling (English).

Because of the salient excrescences found on the serous and cutaneous membranes of diseased animals, the malady has been termed Hirsesucht, Meerlinsigkeit, Zäpfigkeit, Kranichtkeit, Rindshammen, Traubenkrankheit (German), Pearl Disease, Margarosis (Anacker), Knots, Kernels, Grapes, Angleberries, Clyers (Fleming, "Veterinary Sanitary Science and Police," London, 1875, and "Veterinary Journal," 1880, p. 314. Walley, "The Four Bovine Scourges." Edinburgh, 1879.)

The nature of these excrescences is still a matter of dispute. For many centuries they have been considered as of a syphilitic character, and have consequently received the name at first given to the human disease in several parts of the world—such as Franzosenkrankheit (French disease, *German*), Francausowitost pri Krawach (Bohemian), Lustseuche, Unreinigkeit, Venerie et Morbus gallicus boum (Latin). At a later period the nodules and nodosities were considered to be of a glandular nature, and the malady was then qualified as the Drüsenkrankheit (German), Malattia Glandular (Italian).

Several *savans*, renowned for their anatomo-pathological knowledge, have endeavoured to determine the histologic texture of the neoplasms which are developed on the serous membranes during the progress of the malady. The earlier investigations made with a view to elucidate this point, gave rise to the belief that those pathological vegetations were of a sarcomatous nature; later, they were considered fibrous tubercles, and still more recently as neoplasms peculiar to the bovine species; while at the present time they are looked upon as veritable tubercles.

These different views of the neoplasms of bovine Phthisis have been the cause of giving yet more names to the disease, such as: Cachexia boum Sarcomatosa, Sarcomatosis Infectiosa, Sarcotuberculosis Infectiosa, Tuberculosis Fibromatosa, Sarkomdyscrasia, Tuberculosis Pleuralis, Cachexia boum Tuberculosa (Tscheulin and Wagenfeld), Rindstuberkulose (Leisering), Primary Tuberculosis of the serous membranes.

As the disease is frequently met with in the pig, and nearly as often in bovines, in the form of Scrofula, it has also received this name, and that of Scrofulo-tuberculosis, proposed by Walley.

Most frequently it is known in France as Phtisie pommelière,

and in Germany as *Perlsucht*, or Tuberculosis. The latter designation is most admissible, because of the relations of this bovine affection to Tuberculosis in man.

The two last-named designations have, no doubt, been chosen because one of the most salient characters of the malady consists in the appearance in the tissues of the diseased animal, of miliary nodosities, which, after having during a short period of growth attained a certain volume, degenerate, becoming caseous and calcareous. These nodosities differ from other analogous productions, *inasmuch as they are capable of being transmitted by inoculation to nearly all the domesticated animals, and their transmission gives rise to the production of new nodosities, which, analogous to those from which they were derived, may in their turn be successfully inoculated.*

Conformably with these characteristics, we might consider the designation of *Tuberculosis panzootica contagiosa* as being the best of all those enumerated; though it may be remarked that if the nodosity is really the essential alteration in this disease, it is not the only one, and therefore is not the characteristic or pathognomonic lesion. So that although, from an absolute point of view, we give the preference to the last-named designation, we will nevertheless employ the term Tuberculosis (*Phtisie pommelière*, *Perlsucht*), because of its simplicity.

The great number and diversity of the names given to this disease might lead us to suppose that it has often been confounded with others affections which have only a superficial resemblance to it, or have certain characters common with it.

To give only one example of this confusion, it may be mentioned that, until within the last few years, *Echinococcus* kysts have been mistaken for Tuberculous neoplasms, although so long ago as 1821, Tscheulin had drawn attention to the differences existing between these two lesions; and the same error has been made with regard to the *Cysticercus cellulosus*.

Apart from these grosser errors in diagnosis, there occurred others more excusable; for besides those parasitic creatures visible to the naked eye, there were others of microscopical dimensions which could also develop in the domesticated animals, and cause the formation of nodules and nodosities which,

like the tubercular neoplasms, might undergo calcation or calcareous infiltration. Certain lesions produced by foreign bodies and enkysted in organs, might also be confounded with these neoplasms—the foreign matters most frequently belonging to the inorganic world, and arriving in one way or another in the interior of the living animal.

Not only have all these lesions been mistaken for those of Tuberculosis, but the alterations which are met with in chronic Broncho-pneumonia, Bronchiectasia, abscesses and softening centres seated in the hepatised or sclerosed pulmonary tissue, as well as the lesions due to Pyæmia, or those belonging to some carcinomatous affection, have likewise been mistaken for the malady in question.

If the lesions of Tuberculosis have often been confounded with alterations which were perfectly distinct from them, it has been sometimes sought to separate the lesions of this malady, and to consider apart the alterations which are really an integral part of it. Thus it has happened that in Germany, Austria-Hungary, Switzerland, and England, certain authorities have described two forms of the disease—pulmonary and pleural Tuberculosis—which have been considered by them as quite distinct affections, and treated as such in their manuals of pathology and in legal arrangements.

We may add that recent researches have discovered maladies which are now fixed as tuberculous, and the existence of which was previously ignored, or their manifestations were misinterpreted.

Taking all the circumstances into consideration, we need not be astonished at the numerous voids that still remain in the symptomatology of Tuberculosis, and it can easily be understood that the diagnosis of the disease is looked upon as very difficult, and even often impossible. Certainly the difficulties in the way of diagnosis are real; they are the consequence, in many cases, of the slow and insidious course of the disease, which sometimes lasts for years, and the phenomena of which often pass unperceived. And besides, as the morbid products of the malady may, in certain cases, be deposited in organs which, under ordinary conditions, would remain free from them—as in the

brain, spinal cord, kidneys, genital organs—and produce special manifestations, it is scarcely possible to trace in a precise and definite manner all the symptoms which mark the presence of the disease in every case.

Similar difficulties in diagnosis are, however, equally met with in other disorders—as in the contagious Pleuro-pneumonia of bovines, and in Glanders. The first of these diseases has likewise a slow course, and we may affirm without much fear of contradiction, that a good number of cases of this malady escape detection; while with regard to the second, it is notorious that its progress and symptoms are very much varied; and yet, notwithstanding these somewhat unfavourable conditions as to diagnosis, the clinician is often able to determine the nature of these maladies, and eventually to recognise their existence.

The difficulties in diagnosing pulmonary Tuberculosis are, however, actually greater than in contagious Pleuro-pneumonia, because the differential diagnosis of the former has not attracted much attention, and also because the general tendency of medical men towards anatomico-pathological researches, which has been so notable in recent times, has somewhat led to the neglect of observations and clinical investigation with regard to these two diseases.

The establishing of a precise diagnosis being of the greatest utility, and being as indispensable for those who are engaged in practical medicine as for those who are occupied with veterinary sanitary police, a knowledge of the means of diagnosing the disease should be considered as the primary, and one of the most important tasks imposed upon those who occupy themselves with practical or theoretical medicine, or even the natural sciences only.

If we recognise the voids which medical knowledge offers us in this respect, we, nevertheless, cannot ignore the considerable progress which has been the consequence of the great improvements introduced into medicine by Laennec and his disciples.
Vivat sequentes!

The following is extracted from an excellent description of the

disease, dated 1840, and published in an Ordinance of the Canton of Appenzell-Ausserhoden of that year:*

“Cough short, interrupted, and dry; most marked in the morning, at the time of feeding, and (most frequently) after a few violent movements. At the commencement of the disease, the animals are frequently still in a state of average plethora, and they may, if food is good and abundant, acquire a certain degree of obesity. If the malady progresses, the animals become more and more wasted, and the symptoms which mark a nutritive change become more evident. The hair becomes erect, dull, and matted; the skin looks dirty, is tender, and clings to the bones, appearing very pale at the parts little covered with hair, as in the perineal and mammary regions; the temperature of the body descends below the normal standard; the eyes sink in the orbits, as the fatty cushion at the back of the eye disappears, and look as if drowned in water; the gaze is dead; the cough at this time is more frequent than previously, but it is seldom, if ever, accompanied by nasal discharge. The vital turgescence of the tissues becomes less and less marked; the patient wastes more and more, notwithstanding the preservation of the appetite and an abundant and good supply of food.

“Coincidentally with these symptoms, the mammary secretion becomes almost insignificant in milch cows. Sometimes the patients exhibit an abnormal sensibility on pressing the breast and lateral parts of the chest; this sensibility, which is sometimes present from the very commencement of the disease, is much more frequent and pronounced at a more advanced period, and is denoted by groans, attempts to evade pressure on the diseased parts, cough, etc.

“The malady may nevertheless be present without any symptoms being noted.

“The animals which, notwithstanding the existence of the disease, may fatten well, are in certain countries known by the name of *fette Franzosen* (fat French beasts).

“It sometimes happens that with diseased animals there are manifestations of Nymphomania. In these cases it is observed

* Archives Suisses de Medecine Vétérinaire. New series, Vol. VIII., p. 369. Zurich, 1846.

that in a cowshed there are signs of restlessness and agitation in one of the cows. If it is eating, it suddenly ceases to do so and fixes its eyes on any one who may have chanced to enter the stable; it paws the ground and often bellows; stretches out the head and neck; the eyes appear to start from their orbits, and it looks as if it would fly to attack the visitor who has provoked these indications. The labia of the vulva are usually tumefied, and very sensible to the touch; the clitoris is very developed; the vaginal mucous membrane is congested and violet in colour; the sacral and ischiatic ligaments, as well as the connective and aponeurotic tissues covering them, are, as in the skin of these regions, relaxed to such a degree that the lateral parts of the sacrum and the tissues of the ischial region of the pelvis appear to be more or less depressed or subsided (*abig'heit*).

"These tuberculous nymphomaniac cows exhibit, besides, venereal manifestations which differ from the ordinary phenomena of the organism, by the moment when they appear, by their intensity, and by their persistency, notwithstanding coition having taken place.

"With these animals the venereal desires are evidenced by inquietude, indocility, a great desire to jump on other animals, and a considerable flexion of the croup produced on touching this region. Animals affected with the disease in this form give very little milk and rarely fatten well."

The manifestations of Nymphomania are not specially indicative of the presence of Tuberculosis, however but may present themselves in the course of other affections.

For instance, Stirnimann* observed them in certain cases in which the ovaries of the patients were affected with alterations different to those of Tuberculosis.

Rychner† reports the clinical manifestations of Tuberculosis as follows:—"The young animals attacked by the disease do not profit, like the other animals, from the food they receive, but appear to remain behind those of the same age, and fed in the same way, so far as nutrition is concerned. Animals of a certain age visibly pine away from day to day, and soon fall into a state of

* Archives Vétérinaire de la Suisse. Nouvelle Séries. Vol. XI.

† Zeitschrift für Thierheilkunde, 1845.

marasmus. From time to time during the day they emit, under the influence of various causes, a short, feeble cough.

“Notwithstanding the exhibition of the most effective expectorants, this apparently catarrhal affection does not ‘ripen,’ as we may say—that is, the cough does not become deeper or softer

“The owner may, in such a case, doubt the existence of Tuberculosis ; there is, consequently, need to examine the animal carefully and minutely.

“If pulmonary Tuberculosis is present, it will be observed that the movements of the ribs and wings of the nostrils are effected when the creature is in a state of repose, without any marked disturbance unless the disease is in a very advanced state. But if the cow is compelled to walk a little quickly, there ensues dyspnœa and laborious respiration.

“In those cases in which the alterations of pulmonary Tuberculosis are not so advanced, this dyspnœa will scarcely be noted during repose : but it becomes evident, and even so pronounced as to assume the abdominal character, if the pleura is invaded by the disease. In the latter condition, there is more than ordinary sensibility exhibited on pressure, more especially above and behind the shoulders, along the back, and in the costal region.

“The localisation of Tuberculosis on the pleura is rendered evident by the dull sound yielded on percussion, while this mode of exploration only furnishes the vaguest indications in those cases in which the localisation of the morbid process has taken place in the pulmonary parenchyma.

“On auscultation of the chest, there are discovered in these cases, and in certain places, an altered respiratory murmur, an abnormal *bruit*, most readily perceived when the chest of the diseased animal is auscultated and the sounds compared with those of the lungs and pleura of a healthy animal.”

The *bruit* which is heard in auscultating the thorax, and sometimes even the abdominal wall, in cases of pulmonary Tuberculosis, is produced by the friction of the vegetations of which the peritoneum and pleuræ are the seat. In Germany this bruit is designated by the terms *Perlreiben* or *Perlschaben*. Dr. Vogel,*

* Lehrbuch der Physikalischen Diagnostik. Stuttgart, 1874. Wochenschrift für Thierheilkunde und Viehzucht, 1873. Nos. 10, 11.

in giving a classical description of it in a treatise on pathology, has provided clinicians with the means of distinguishing between Tuberculosis and Contagious Pleuro-pneumonia. He says :—

“ 1. The sound furnished by percussion of the thoracic wall of a phthisical animal is not an empty sound, and in percussing its chest we do not perceive that resistance which percussion gives in cases of Pleuro-pneumonia.

“ 2. The dead sound is only produced in percussion in an animal affected with Phthisis, at the points corresponding to the nodosities.

“ 3. In this disease the absence of respiratory murmur and bronchial souffle is most frequently only remarked in circumscribed regions.

“ 4. Finally, auscultation of animals which are not phthisical does not reveal the cavernous and metallic sounds sometimes noted in Tuberculosis.”

“ In Phthisis evident friction sounds are only met with when the nodosities are tubercular, and have already undergone calcareous infiltration.

“ In order to hear this abnormal *bruit*, the affected animal should be placed in a very quiet place, fasting, after having undergone moderate exercise, and care should be taken to apply the ear to the diseased region.

“ The friction sound perceived in Phthisis is characteristic, and differs from the friction sounds of Pleurisy and those of the rumen, inasmuch as—

“ 1. The Pleurisy sound is not persistent, and disappears when the exudate becomes abundant ; it reappears when absorption takes place, and then usually with greater intensity than at the commencement ;

“ 2. In Phthisis the friction sound persists, and is not heard over such an extensive surface as in Pleurisy ;

“ 3. In Pleurisy the friction sound is more marked than in Phthisis, and resembling the sawing or rasping *bruit*. If Pleurisy co-exists there is fever present ;

“ 4. As a general rule, it suffices to place the hand on the thoracic wall in order to perceive the pleuritic friction sensation, while percussion in Pleurisy demonstrates that the production of the dull sound is limited by a horizontal line ;

"5. The pericardiac friction sound is isochronous with the pulse ; that of Phthisis corresponds to the movements of expiration and inspiration ;

"6. In order not to confound the friction sounds of Phthisis with crepitant *râles*, it suffices to make the animal cough, or give it water to drink ; in the latter case the *râles* most frequently disappear, and the production of other *râles* is momentarily suspended ;

"7. The existence or non-existence, as well as the characters of the movements of the gastric apparatus, permits a distinction to be drawn between the friction sound of Phthisis and the *bruits* produced in the rumen."

All these indications are certainly valuable, but they do not constitute a complete and characteristic symptomatic *tableau* of Phthisis.*

It results from the experiments as carefully made on animals as possible, that the commencement of this disease is marked by slight febrile reaction, accompanied by rigors and heat, anorexia, indigestion, and abnormal coloration of the mucous membranes. In general, these symptoms disappear after a few days, and at the same time there is developed a sensitiveness and abnormal tumefaction of the superior, middle, and inferior cervical lymphatic glands, as well as those situated at the entrance to and the lower part of the chest, as also sometimes those of the axilla. These glands at a later period become hard and nodular. At a more advanced period of the disease, there is again slight fever, which is manifested by accesses or remittances, and the existence of which may be readily ascertained by employing the thermometer. The evening temperature, in some cases, reaches from 102·2° to 105·8° Fahr., while in the morning it is often very low when the disease is advanced, descending perhaps to 98·6° Fahr.

The urine is usually neutral, sometimes albuminous ; it contains a somewhat unusual proportion of salts, especially after the paroxysms which often set in during the course of this affection.

* Mr. Martin, M.R.C.V.S., Rochester, read an able paper before the Southern Counties Veterinary Medical Association, which was published in the VETERINARY JOURNAL for November, 1881, on "Some of the Differences between Contagious Pleuro-pneumonia and Tuberculosis, from a Sanitary Point of View," in which some of the differential symptoms of the two disorders are clearly given.—C. F.

Usually the milk derived from phthisical animals does not offer anything unusual at the commencement of the disease, but as soon as emaciation and fever supervene, the secretion is diminished in quantity as well as altered in quality. It becomes bluish in tint and richer in salts than usual; though this modification is not invariably related to a marked decrease in quantity.

Jessen* reports the case of a cow affected with Phthisis, and which was apparently in good health until five to six years of age. It yielded in milk from

Jan. 24, 1866, to Jan. 23, 1867	...	2,325	litres
„ 1867 „ 1868	...	2,725	„
„ 1868 „ 1869	...	2,025	„
„ 1869 „ 1870	...	2,168·75	„
„ 1870 „ 1871	...	2,162·50	„
„ 1871 to Dec. 1871	...	1,658·50	„

The analyses of milk derived from phthisical cows prove that it has a very variable composition, a circumstance which might be anticipated.

Diseased cattle sometimes manifest dysphagia, ordinarily due to tumefaction of the cervical lymphatic glands, as well as a capricious appetite, intermittent tympanitis, and constipation alternating with diarrhoea and colic, without any ascribable cause. In other cases there is a permanent or intermittent nasal discharge of a mucous, purulent, or sanguinolent character.

In certain exceptional cases, the expired air and the nasal discharge exhale a foetid odour. Sometimes one or other of the costal parietes is more or less depressed and wasted; in other cases, during the course of the disease there are very limited muscular contractions, cramps, paralyses, with tonic contraction of the muscles of the neck, epilepsy, turning round, coma, or blindness. In yet other cases, there supervene during the progress of the malady, tumefaction and increased sensibility of the testicles or scrotum, Hydrocele or Mastitis—the latter invading sometimes the entire organ, sometimes only one-half or one-quarter, and terminating in nodular neoplasms. Another complication of this malady is swelling of the bones without external

* "Wochenschrift für Thierheilkunde und Viehzucht," 1872, p. 346.

lesion, with caries, lameness, articular tumefactions, and the formation of certain warts. These manifestations will be again alluded to.

The course of the disease varies greatly, the symptoms either developing rapidly or tardily, and their manifestation is maintained during the whole period of the malady, or they are intermittent. The disease may, in every case, be classed among those of a chronic nature, and especially among those which continue as long as the normal life of the animal itself. In certain cases, however, it passes through its different phases in the space of three months, and sometimes even less. It at times follows an *insidious, concealed, or occult* course, and either escapes observation or is recognised tardily; and it only causes death rapidly and immediately if its morbid alterations are very extensive, or if they are localised in important organs.

Phthisis may co-exist with other maladies, or it may lead to the production of disease—as Pleurisy, Pneumonia, Bronchitis, Peritonitis, Hæmaturia, etc., so that the morbigenous agent of Tuberculosis does not protect the organism from the influence of any other morbid cause.

If, as appears from what has just been stated, Phthisis may present itself under very various manifestations, it is none the less established that an observant proprietor will quickly recognise the disease among his stock. He will notice that one or other of them is duller than usual, that its appetite is diminished, its skin has lost its suppleness, and the hair its smooth, glossy aspect of good health.

The animals least affected feed well, but do not appear to profit by their food; they are easily fatigued, cough, and gradually present more and more numerous morbid manifestations. The owner or breeder generally takes good care to get rid of these animals, even when he is not completely certain as to the real nature of the malady with which they are affected; and he does this all the more readily as the cows often do not breed, or else have a great tendency to abort if conception does take place. If, however, the animal is a milch cow, it will probably be sold to a dairyman. Oxen, young cattle, and bulls, are, in these cases, attempted to be fattened, and then sent to a slaughter-house in one or other of the large towns. The cows which do not give

milk, as well as those which will not fatten, are slaughtered, and their flesh is sold for local consumption, or manufactured into some form of food ; though not infrequently it finds its way into the sheds of poor farmers or others, to be fed for the market.

If, therefore, the attentive breeder or intelligent cowman can recognise this disease, and appreciate it at its just value, so that he is able to separate phthisical animals as soon as possible from his stock, it may be admitted that the veterinary surgeon, armed with all the mechanical resources of his art, for the exploration of the exterior (and interior) of diseased creatures, in the form of stethoscope, pleximeter, measuring tape, mirror, weighing-machine, etc., and with the advantage of being in a position to examine them by rectum or vagina, should be competent to diagnose the presence of the disease in the great majority of those attacked by it.

If our knowledge with regard to the means by which to combat this malady has made but little progress, the cause for this may be found, in great part, in the idea which is largely entertained that it cannot be recognised during life—an idea which we believe to be baseless, although it is held by a great number of veterinary surgeons. It is not proper that veterinary surgeons should continue to shield themselves behind this certificate of insufficiency or incapacity. Our knowledge of its symptomatology is not more advanced in this disorder than in many other maladies ; and, besides, the discovery of the contagious principle of Tuberculosis should lead to the hope that we shall soon be able to recognise the existence of the disease by the detection of its cause alone. This new means of diagnosis will probably permit us to discover Phthisis in cases in which the nature of the affection cannot be otherwise determined, and aid us in elucidating certain points still obscure or unknown in its pathological history.

Our anatomo-pathological knowledge of this disease offers fewer *lacunæ* than do our means of diagnosis, properly so-called. The necroscopic lesions that are most frequently met with on opening the bodies of animals which, during life, were affected with the malady, and especially when these lesions are localised on the serous membranes, are neoplasms of the costal and peritoneal pleuræ, with their consequences. These neoplasms are in various

forms. Their volume is from that of a millet-seed to that of a pea. They are present singly, or are united in grape-like masses; they are pedunculated, or have the form of a polypus, and sometimes even that of a wart; they are reddish-coloured, like flesh, or have a yellowish-brown tint; their consistence is variable. Frequently the centre of the soft nodosities is deep red, while in the hard neoplasms the central portion is yellow and caseous, or has the consistency of mortar. According to Virchow, the tubercle neoplasms appear first in the form of little nodosities or "pearls," united into groups or clusters like bunches of grapes, which project from the surface of the serous membranes. At a later period, these neoplasms become pedunculated, and the small nodosities are separated from each other by some vascularised bands of connective tissue. Still later, lime salts are deposited in them in the form of points or reticulations, and the transformations still continuing, the nodosities finally become a softened mass resembling thick mortar.

The illustrious Berlin professor states that he has never observed any other transformation of these neoplasms, than calcareous infiltration and partial fatty degeneration.

It is only in exceptional cases that, in the course of this malady, alterations are not found in the lymphatic glands of the head, neck, or chest, or in the submaxillary, parotidean, superior middle, or inferior cervical, the maxillary, prescapular (*glandulæ cervicales*, Hom.), superior and inferior parietal (*glandulæ sternales*), thoracic (*glandulæ parietales superiores et inferiores thoracis*, Hom.) glands. The lesions are also met with in the anterior and posterior mediastinal, as well as in the bronchial lymphatic glands.

These glands are at least more or less enlarged, have a dull yellowish colour, and are impregnated with juice, or they are pigmented. Frequently, also, there are hæmorrhagic centres the size of a pin's head, with notable increase in volume and induration of these glands, and irregular contours. On section, the cut surface shows numerous infiltrated points, the size of a grain of millet to that of a pea, grey, yellow, or white in colour, and having the consistency of cheese or mortar. There are also larger centres, irregular in outline, and formed by masses having analogous characters to those just described.

In addition to the nodosities on the serous membranes, and the nodular and caseous transformations met with in many of the lymphatic glands, pulmonary lesions are found in the majority of the animals affected with tubercular phthisis. These are in the form of nodules and nodosities, possessing similar characters to those already mentioned ; in the lung parenchyma they are observed to be in all their stages of evolution, from the hæmorrhagic points to the caseous and calcareous nodosity. Besides these connective-tissue vegetations, which may cause complete obsolescence of the pulmonary lobules and acquire considerable dimensions, and are at the same time often permeated with centres of regressive transformation, there are other irregularly-formed centres of various dimensions, caseous in appearance, and situated in the pulmonary parenchyma, which do not present any other abnormal character.

Sometimes the pleural nodules or nodosities of the costal or mediastinal pleura extend to the parietal or visceral pleuræ, and bring about adhesions between the lungs and costal walls, or the mediastinal septum or pericardium. It may even happen that the pleural nodosities penetrate the pulmonary parenchyma, and the invasion may be so complete that it is impossible to distinguish the pulmonary from the pleural nodosities.

The conglomerated nodosities which form the caseous or mortar-like masses may, if they are situated beneath the pleura, penetrate the latter, throwing their contents into the pleural cavities, and give rise to a rapidly fatal Pleurisy, or to Pneumothorax. If the masses of nodosities are found in the vicinity of a bronchus, they may open into its cavity, and their contents be expelled in discharges from the mouth or nostrils. When these softened centres open into the pleural sac or the bronchi, there results the formation of abnormal cavities in the pulmonary parenchyma ; these are the so-called *vomicæ* or *caverns*.

The following is a very exact description of the necroscopic lesions met with in tuberculous animals ; it is taken from the *Dictionnaire de Médecine Vétérinaire* of Hurltel d'Arboval (Paris, 1839. Vol. v., p. 35) :—

“The ribs having been removed from the carcase of a cow sent to the knacker, the pleura was found to be entirely covered

with tubercles variously disposed and variable in volume, the largest not exceeding in size that of a nut ; they were arranged in lines in some parts, in chaplets in others, and especially where the lungs had contracted adhesions ; the whole of the right lung was studded with tubercles more or less large, some being imbedded in the tissue of the organ, while others, more superficial, were only attached to it by a pedicle. The extremity of this lung was converted into a concrete matter, of the same nature as the tubercles. The left lung offered a similar concretion, with regard to its nature, but less in extent ; the mediastinæ were transformed into a mass of tubercles arranged like the cotyledons of a cow which has just calved ; the bronchial glands were greatly engorged ; the abdomen offered the same kind of lesions as those found in the chest. The peritoneum was, like the pleuræ, studded with tubercles in every respect the same as those described above ; the mesenteric glands were very consistent, of a dark grey colour, and they had acquired an enormous volume."

These nodules are not only met with on the serous membranes, lungs, and lymphatic glands ; they are also found in other organs, and particularly in the mucous membrane of the larynx and trachea, pharynx and œsophagus, being situated in the membrane itself, or in the submucous connective tissue, where they readily become softened, and then give rise to the formation of small ulcers disposed in a funnel-shaped manner ; these, in becoming confluent, cause the loss of much substance, abscesses in the submucous connective tissue, and necroses of the already ossified cartilages. These nodosities comport themselves, in this respect, absolutely like the pulmonary tubercles which throw their contents into the pleural or bronchial cavities, and like the glanders nodosities of the mucous membranes or skin which ulcerate.

We may be permitted to give some examples of these ulcerations, as observed in tuberculous cattle. Schruber, a veterinary surgeon in the district of Eglisau, reports the following case : "An extremely emaciated cow succumbed while in advanced pregnancy, and after having, in the preceding year, suffered from a violent affection of the chest, with considerable tumefaction of

the thyroid glands and all the parts in the vicinity of the larynx, though its health improved afterwards. On opening the carcase of this animal, there were found in the lungs a considerable number of indurations, some small, others voluminous. These organs were, besides, the seat of purulent centres containing liquid pus and a concrete gritty mass. On the inner surface of the trachea there were three very extensive ulcers in active suppuration, one of which had extensively invaded the larynx. All the other organs were healthy.*

Veterinary Surgeon Casper Krauer cites the case of a phthisical cow which, while eating, pawed the ground with one or other fore foot, swallowed with difficulty, salivated abundantly, but rarely coughed. At the autopsy he found tubercles in the mucous membrane of the trachea.†

Walley shows in Plate X. of his work,‡ a drawing of tubercles and tuberculous ulceration of the larynx; the second figure in the plate represents the tuberculous transformation of the tracheal mucous membrane.

Connective-tissue hypertrophy, as well as nodules and nodosities analogous to those already described, are also met with in the tongue and lips. But, according to Bollinger, these alterations in Tuberculosis must not be confounded with the indurations of the tongue known in Germany as "*Holzzunge*" (*Wooden tongue*), which are the consequence of the development of the *Actinomyces bovis* (Harz); these parasitic nodosities are sometimes found in process of cretification.

On the envelopes of the encephalon, as well as of the spinal cord (especially on the pia mater and arachnoid), and, in certain cases, even in the substance of the brain and medulla oblongata, there are sometimes found yellow nodules the size of a grain of millet to that of a hemp-seed. These may collect into a mass at a certain point, and constitute a tumour or vegetation sufficiently voluminous to compress one part or another of the brain or spinal cord, occasioning those nervous disturbances already alluded to. The nodosities situated in the brain not unfrequently soften, and give rise to more or less extensive puriform centres.

* "*Archives Suisses de Médecine Vétérinaire.*" Zurich, 1847, p. 383.

† *Ibidem.* 1857, p. 242.

‡ "*The Four Bovine Scourges.*" Edinburgh, 1879.

At Willer (Upper Alsace), where Tuberculosis is very prevalent, Zundel has found, in making an autopsy of two cattle which had succumbed to the contagious disease of the head, numerous grey granulations, the size of a grain of millet, on the membranes of the brain. One of these animals had also tubercles in the bronchial glands. In another animal tubercles were found in the skin of the forehead, one of which was as large as a pea and had yellow contents, while similar neoplasms were met with in the bronchial glands, and in the left lung were tuberculous granulations, varying in size from that of a pea to that of a nut. From these appearances, Zundel was of opinion that the contagious disease of the head of cattle might very well be accepted, in veterinary medicine, as representing the tuberculous meningitis of children, first described by Russ and Gerhard.*

We have already mentioned the existence of tubercular nodosities in the abdomen of animals affected with this disease ; these may be situated on the mesentery, in the mesenteric glands, or on the omentum. The veterinary surgeon of the district Von Ow, mentions a special kind of colic observed in the cow, and due to the tubercular transformation of these parts ; he is even able to diagnose, during life, the special nature of these colics, in having recourse to exploration of the rectum.†

It is not rare to find, at the same time as the alteration of the mesenteric glands is met with, that special morbid condition of the intestinal mucous membranes described by Professor Niklas, of the Munich Veterinary School, under the name of Intestinal Tuberculosis, in the following terms :—"This morbid condition has not yet, I think, been described. Köll formally declares that he has never met with intestinal Tuberculosis, not even when the lesions of this affection were found in other organs. I have had the opportunity of observing this alteration in more than twenty cows, not only in animals whose other organs were affected with tubercles, but also in those which nowhere else gave evidence of the existence of the disease. In these cases the tubercles were of variable dimensions, from the volume of a pin's head to that of a hemp-seed ; they were seated on the internal surface of

* "Recueil de Médecine Vétérinaire." 1872.

† "Thierärztliche Mittheilungen Von Lydtin." 1881, p. 79.

the serous membrane, and sometimes in very considerable numbers, disseminated throughout the whole of the intestine, or accumulated in certain points.*

It is in this group of maladies that must also be included that intestinal disease of the pig, which so often causes fatal constipation or diarrhœa, and to which the designation of Scrofulosis is given when its course is chronic.

The district veterinary surgeons in different localities of the Grand Duchy of Baden have often remarked, in their reports, on the frequency of Tuberculosis among the animals fed on the residues of the distilleries and kitchen refuse. The infection in these cases, they state, had its point of departure in the intestinal canal, as nodules were rarely absent from it.†

The nodules of Tuberculosis are also met with on the surface of the liver and spleen, but most frequently in the parenchyma of these organs; and the kidneys are not exempt from these lesions.

According to a recent communication of veterinary surgeons Fischer of Wolfach, and Merkle of Zell, a form of incurable and fatal chronic hæmaturia met with among the cattle in the Black Forest, is due to a tuberculous and ulcerative transformation of the coats of the bladder.

The genital apparatus may likewise show nodules of Tuberculosis, as they have been found in the vaginal sheath and in the testicle,‡ in the spermatic cord and efferent ducts, as well as in the prostate.§

In female animals these lesions are rarely met with in the mucous membrane of the vagina; but they are frequent in the uterus, Fallopian tubes, and ovaries.

In the collection of pathological specimens at the Veterinary School at Karlsruhe (which is no longer in existence), there was a uterus weighing more than fifty kilogrammes ($3\frac{1}{2}$ cwts.), the walls of which had attained a thickness of three centimètres

* "Wochenschrift für Thierheilkunde und Viehzucht." Third year, No. 52, p. 434.

† "Mittheilungen über das Badische Veterinärwesen, 1874-1880." Karlsruhe, 1882, p. 78.

‡ *Ibidem.*

§ Walley. Op. cit., p. 176.

(about $1\frac{1}{4}$ inch), as a result of the production, in multiple layers, of yellow nodosities and connective-tissue vegetations between these. The numerous ulcerations on the surface of the mucous membrane of this uterus gave it a kind of resemblance to an empty honeycomb.

The formation of tuberculous nodosities in the udder, which had been mentioned so long ago as 1849, has a real importance. From the report issued by the direction of medical affairs of the Canton of Zurich for the year 1849,* it would appear that Nägeli observed a case of localisation of this disease in the mammary gland, and which he reports in the following terms:—
“A cow showed, between the teats of the udder, nodosities which were at first supposed to be the ordinary milk indurations, but at a later period they became very painful, softened, and gave rise to ulcerations. The loss of substance thus produced caused an abundant discharge of sanious and corrosive fluid. At the commencement, the secretion of milk was evidently scarcely altered, except that it was diminished in quantity. The cow became emaciated and fell into a cachectic condition”

Degive, professor at the Brussels Veterinary School, and Van Hertsen, inspector at the abbatoir of that city, have presented to the Brussels Academy of Medicine a memoir on the localisation of this affection in the mammary glands and in the muscles.

The veterinary surgeon of the Von Ow district, in Baden, relates the case of a cow which had the localisations of Tuberculosis in the mammæ.† “A brown cow, of a delicate constitution, but a good milker, was attacked by a violent inflammation of the left half of the udder, which resisted every kind of treatment. The udder increased in size, especially the left side, and the secretion of milk was completely suspended. When the symptoms had continued for several weeks, the cow commenced to cough and to breathe with difficulty—phenomena which were soon complicated with manifestations of fever. The diagnosis was pulmonary inflammation. The animal, being still in good condition, was killed, and on examination of its body there were

* “Schweizerisches Archiv für Thierheilkunde.” New series. Vol. XI., p. 243.

† “Thierärztlichen Mittheilungen.” 1879, p. 103.

found tuberculous nodosities on the pleura, as well as in the udder, where they were in great number."

Veterinary surgeon Fischer, of Wolfach, has reported an analogous case, in a discourse at a meeting of Badenois veterinary surgeons held at Friburg in 1882.

Fünfstuck, Dinter, Ackermann, Hartenstein, König, and Präger have also given similar instances, if we may judge from the reports of veterinary surgeons in Saxony for the years 1870, 1872, 1874, 1875, 1876, and 1879.

Tuberculosis of the mammæ has also been mentioned in the works of Gluge, Bruckmüller, and Furstenberg. It is also alluded to at length in the *Thierarzt* by Anaker (1878, p. 104), the *Oesterreich-Monatschrift für Thierarzt* (1879), and the *Mittheilungen aus der Thierärztlichen Praxis* (Prussia, new series, 1879-80, p. 14). The presence of these nodosities in the muscles is a fact of not less importance than that of their existence in the mammæ.

Tuberculosis of the cardiac muscle has been mentioned by Ruff, veterinary surgeon in the district of Bretten, and by Von Ow at Stockarch,* by James,† and by Surber.‡ The latter found a tuberculous tumour weighing twenty-seven pounds on the heart of a fat ox.

In the anatomo-pathological collection of the Berlin Veterinary School, there is preserved a piece of flesh full of miliary nodules, and Dr. Schütz of that school has noted that these small nodules are situated in the intermuscular substance. In animals which are in an advanced stage of Tuberculosis, we often find tubercular productions in the intermuscular lymphatic glands, but which often pass unnoticed.

The neoplasies of Tuberculosis are also often encountered in bones and the articulations. According to Walley,§ the lesions of this disease are relatively more frequent in the cancellated than the compact tissue of bones. They are more especially met with in the spongy portion of the temporal and occipital

* "Thierärztliche Mittheilungen von Lydtin," 1875, p. 51.

† *Veterinarian*, 1873.

‡ "Schweizerisches Archiv für Thierheilkunde." Neu Folge. Band XI., p. 42.

§ *Op. cit.*, p. 179.

bones, as well as in the spinous processes of the dorsal vertebræ. The diploe of the bones are, in these cases, the seat of an inflammation and exudation which produces an hypertrophy, with softening, of this tissue; the nodosities are deposited in the substance of the new formation, and are easily recognised.

With regard to Tuberculosis of the long bones, it proceeds either from the spongy tissue of the epiphyses or the endosteum, and perhaps in certain cases from the periosteum alone.

In making the autopsy of a bull which, during life, had exhibited symptoms of a cerebral lesion, and especially of deranged motility, sensibility, and intelligence, while at the same time there was a discharge from the right ear, Krebs found, in addition to tubercles in the lungs, a large tuberculous centre which had invaded the temporal, sphenoidal, and occipital bones.* These were partially softened, and the altered parts contained tuberculous neoplasms. In the neighbourhood of the left temporal bone, the pathological productions had perforated the dura mater, the inner surface of which they covered with a layer of fungous growths. The left half of the brain, as well as that of the cerebellum, had deep depressions in which these neoplastic masses were imbedded. In the region of the sphenoid and occipital bones, these tuberculous vegetations formed, on the surface of the dura mater, a layer about two centimètres in thickness; the petrous temporal was nearly destroyed, and the cavity of the tympanum was filled with pathological productions similar to those existing elsewhere. A fistulous canal commenced at the external auditory meatus and passed into the cranial cavity, passing through the petrous temporal. The pia mater was the seat of numerous tubercles.

Utz, an arrondissement veterinary surgeon, reports a remarkable case of articular Tuberculosis as follows:—"A cow, five years old, exhibited during life the ordinary symptoms of pulmonary Tuberculosis, *i.e.*, deranged nutrition, progressive emaciation, dyspnœa, varied abnormal respiratory *bruits*, cough, movement of the hind limbs very difficult, and walking stiff and slow, with marked lameness. One of the knees was moderately

* "Archiv für Thierheilkunde." Vol. VII., p. 148.

swollen, and painful on pressure, but was not increased in temperature."*

This cow was killed, and at the autopsy Utz found, in addition to the lesions of Tuberculosis on the two pleuræ, numerous cretified and caseified nodosities in the lungs and liver. On opening the diseased knee, he discovered, covering the entire surface of the synovial membrane, numerous tubercular neoplasms disseminated in places, or collected in more or less considerable groups elsewhere. These neoplasms were indurated, and a large number were cretified; the synovial membrane showed, besides, fleshy vegetations resembling the filamentous masses on the pleuræ, many of which contained tubercular nodosities of a yellowish-red tint.

Weigert has met with the characteristic nodosities of this malady in the walls of veins, and Ponfick has found an infiltration, with tuberculous ulcerations, in the thoracic canal.

In general, the alterations of this affection are only observed in the lymphatic glands of the head, neck, and chest, at the same time that they are found on the pleuræ and in the parenchyma of the lungs; in rare cases they are only noted on the pleuræ or in the lungs.

With regard to the frequency of these alterations in different parts, we might place, in the second line, the abdominal and pelvic organs, and particularly the genito-urinary organs. In the third line come the central organs of innervation, with their envelopes; and after them we may place the bones, articulations, muscles, and intermuscular connective tissue (Schütz), and, lastly, the vessels.

According to the investigations of Göring (Bavaria), in one hundred tuberculous cattle, there were found lesions in—

	In 1877.	In 1878.
lungs and serous membranes in	41 cases,	in 47 cases;
lungs only	" 33	" " 34 " ;
serous membranes only	" 17	" " 15.3 " ;
tubercles in other organs	" 8	" " 3.5 " ;

Of 1,596 cases which were carefully investigated in the Grand Duchy of Baden, the following results were obtained:—

* "Thierärztlichen Mittheilungen," 1881, p. 34.

21	per cent.	with pulmonary lesions only ;
28	„	„ peritoneal and pleural lesions only ;
39	„	„ pulmonary and pleural lesions only ;
9	„	„ generalised Tuberculosis ;
3	„	„ genital lesions only.

The infrequency of the exceptional propagation of the lesions of Tuberculosis in all the living tissues of the organism, leads us to suppose that the cause of the disease is due to an obnoxious substance which may penetrate by different channels into the bodies of animals, and which, no matter where it fixes itself, gives rise to local nutrition-disturbance, resulting in the anatomico-pathological troubles just described. The latter may remain localised, or they may become extended, being propagated most frequently by way of the lymphatics, more rarely by the blood-vessels. From this fact we may conclude that, once developed in an individual, this malady may be propagated in the organs. Consequently, it belongs to the group of *infectious maladies*.

By microscopical analysis of the neoplasms of Tuberculosis, it is recognised that they are composed of :

a. Connective tissue of new formation, but of the ordinary texture, which sometimes is only developed in inconsiderable quantity, in other cases in such abundance that the diseased lungs may acquire a weight of from twenty-five to fifty kilogrammes (fifty-five to 110 pounds).

b. Connective-tissue vegetations, interspersed with variable-sized centres containing the *détritus* of tissues, more or less broken up. With the production of these centres is at first remarked the appearance of hæmorrhagic points, which gradually change their character and soon assume a vitreous aspect—a greyish-blue colour, and have the consistency of old Dutch cheese or of mortar.

These two forms of connective-tissue neoplasm offer a marked tendency to become transformed into osseous tissue ; we may even sometimes observe bony tissue of new formation and completely formed, as is at times noted in Tuberculosis of the diploë. Centres of ossification have also been remarked on the pericardium and in the walls of blood-vessels of animals affected with the disease. The tendency to this transformation

is otherwise indicated by the presence of giant cells, as well as by the deposition in these neoplasms of calcareous and fatty matters.

c. Sarcomatous neoplasms or tuberculous nodosities, properly speaking. The latter are composed of a connective-tissue stroma provided with blood-vessels, and interspersed with round-shaped or fusiform lymphoid elements and a mass of cells. When these neoplasms are recently formed, they are most frequently surrounded by a zone of blood-vessels, the peripheral portion of the cellular mass being formed by cells with well-defined contours and some free nuclei. In the central part of this mass are observed cells less distinct, with more numerous free nuclei ; these soon undergo degeneration. When this process commences, the cells assume an opaque appearance, their protoplasm diminishes in quantity, and at the same time the nuclei become shrivelled.

These altered masses soon become infiltrated with calcareous matters, and are gradually transformed into an amorphous mass presenting all the characters of *bouilli*. In a tubercular nodule, as soon as all the cellular centres, the number of which is sometimes considerable, have undergone these transformations, calcareous infiltration invades the connective tissue in the vicinity, and the whole of the nodosity becomes cretaceous. The pleura becomes thickened in those places which are the seat of neoplasms, and is covered with and infiltrated by granulation cells.

The connective-tissue masses penetrate the pulmonary nodosities in the form of thick bundles, dividing into fine slender fasciculi.*

d. Tubercles or tubercular nodosities, the volume of which varies from that of a grain of millet to that of a fowl's egg. While the vegetations indicated under *a*, *b*, and *c* are developed on the surface of organs, and especially on serous membranes, these latter neoplasms (the tubercles) are produced in the substance of the parenchyma, where they are disseminated or aggregated in more or less considerable masses. At the commencement of their formation, these tubercles are translucid and of small dimensions ;

* "Mittheilungen de Lwow, Kasan." Deutsche Zeitschrift für Thiermedizin, 1881, p. 3740.

later, they increase by the juxtaposition of other tuberculous neoplasms, and then form nodosities of variable volume.

The physical character of these tubercles gradually changes; they become at first grey, and afterwards are yellow in colour; they are destitute of blood-vessels, and are composed only of cells and nuclei without any solid intermediate substance; they rapidly become transformed into a calcareous or caseous mass. The latter is the transformation which is most frequent.

These tuberculous granulations are much more numerous in the organ or infected tissue, than are the other granulations which might be confounded with them.

When a great number of the cretified or caseous tubercles are collected in a part, they form a mass resembling mortar slightly dried (concrements), or they constitute a caseous centre.

e. Ulcers of variable form and dimensions. At the first glance it appears somewhat strange to see one and the same cause give rise to processes so varied in their expression, but this surprise disappears when we analyse the alterations a little closer. Then we find that we have to do with one process only—proliferation of the connective tissue. The differences in the characters of the lesions are due either to the different activity of the intercellular substance, as well as the endothelial and connective-tissue cells, to the degree of disaggregation which occurs so readily in these neoplasms, so poor in intercellular substance, or, lastly, to the ulcerative process, the advent of which is favoured by the special seat of certain of these neoplasms.

The fibrillar vegetations, osseous or cartilaginous, are developed where the connective tissue is abundant, particularly between the pulmonary lobules, and in bones and cartilages.

The cells and nuclei, without connective-tissue stroma interposed, are met with in the tissues in which the epithelial element predominates, as, for example, in the pulmonary alveoli, on the internal membrane of vessels, etc.

With regard to the simultaneous development of cellular and fibrillar vegetations, this is observed on the serous and mucous membranes; it is on the latter that we most frequently meet with the ulcerative process.

Although the irritating agent which determines these different

lesions is the same, yet the effect it produces varies according to the state of irritability of the tissues—that is to say, the more or less active participation of the elements of this process depends upon the soil in which the germ or morbid cause has to act.

The ulterior transformations of the neoplasms depend also upon the nature and condition of the soil.

Whether we accept this interpretation or adopt the opinion of Zeigler, who admits that the neoplasms are due to the emigration of the white cells which, through lack of vital energy, only exceptionally exceed the stage of development corresponding to the fibro-blasts and are rapidly destroyed, we shall scarcely find, in the histologic texture of these neoplasms, characters sufficiently precise to differentiate the pathological process of Tuberculosis from the other morbid processes which originate neoplasms analogous to those that characterise the malady now under consideration.

In glancing over the anatomo-pathological facts, it is remarked that all the infectious maladies which are propagated in a slow and insensible manner, or which invade by starts, but only exceptionally cause rapid death, produce manifestations which are not without a certain resemblance to each other. In these diseases the irritant is more particularly propagated by continuity of tissues or by the lymphatics, more rarely through the medium of the blood.

In Contagious Pleuro-pneumonia, the action of the morbid irritant is specially exerted upon the interlobular connective tissue of the lungs, and it causes an abundant proliferation of that tissue. In Glanders we met with analogous connective-tissue neoplasms, which present themselves in the form of cicatrices, described as independent or, better, primary Glander-neoplasies, by Leisering, who was the first to discover their existence in the lungs; analogous lesions are encountered in the subcutaneous connective tissue and the substance of the skin, when these are affected with Sclerosis or Elephantiasis; in the lungs and glandular organs are found small fibromata and sarcomata with or without very evident cells (veritable Tuberculosis neoplasms); there are found, besides, masses of cells. The

skin and the mucous membranes are very often the seat of more or less extensive ulcers.

Add to these indications that, in recent times, there has been recognised a new infectious malady, Actinomykosis, which produces analogous manifestations in the bones to those observed in Tuberculosis and Glanders—viz., vegetations in the diploë, softening and thickening of the bones, caries, as well as nodules and nodosities in the lips and tongue, purulent and sanious masses in the heart, etc.

A considerable number of creatures which live and die as parasites in the domesticated animals may, after their death, undergo cretification, and then appear as nodules and nodosities resembling those under discussion; but the most remarkable of them are those which are found in the tissues which have been infested by parasites for some time, and which the latter have abandoned for a certain period. Among these nodular productions may be mentioned those described by Utz in the lungs of a sheep. The formation of these nodosities had been caused by filaria (*Pseudalius ovis pulmonalis*), which had sojourned in these organs during the winter. As soon as the worms and their young had quitted their autosity, there remained nothing more in the places previously inhabited by them than cells and nodules with their *détritus*, as well as lime salts infiltrating the tissues. These nests forsaken by the filaria have certainly been often erroneously described as the lesions of Tuberculosis or Glanders.

It results from all these considerations, that lesions of Tubercular Phthisis do not offer any specific features or really distinctive characters, either in their seat, form, volume, colour, or progress, nor yet in their histological elements. The true *criterium* of this disease should be sought for in the irritant which determines it, and which provokes its development (Cohnheim).

If we analyse the nodules or nodosities, the osteo-connective tissue vegetations, the ulcers and softening centres, and find in them the vegetable parasites named by Harz, the *Actinomyces bovis*, we are assured that we have to do with neither Glanders nor Tuberculosis, but are in presence of Actinomykosis.

Pflug is, therefore, perfectly justified in asking us to cease discussing the question as to whether the nodules and nodosities of the serous membranes, lungs, etc., which are met with in this disease, are sarcomatous, fibromatous, lymphomatous, or tubercular. This *savant* is also right in demanding that we abandon the definition of tubercle, such as is entertained at present; for, as he says, it is much more important to recognise the agent which determines diseases than to be acquainted with the microscopic characteristics of their lesions.

The anatomical diagnosis of Tuberculosis is, therefore, scarcely established in a sufficient manner, and very often it has to be completed by an etiological diagnosis. Thanks to the labours of Dr. Koch and his co-workers, we are now enabled to recognise the nosogenic agent of Tuberculosis in examining with the microscope the morbid matter, or even the secreted fluids. The microbe of the malady being found, we are certain of having to do with Tuberculosis.

We consider it necessary to again insist upon the fact, that the anatomo-pathological lesions of Tuberculosis may be present in all the living tissues, and that they represent different degrees of progressive and regressive evolution, varying according to the histological characters and the situation of the organs attacked. These lesions, nevertheless, are not met with in Tuberculosis only, but also in the course of other diseases; though these are affections which, profoundly affecting the organism, have generally a chronic course and belong to the infectious maladies.

The analogy which exists between these latter diseases and Tuberculosis, is a new proof that this belongs to the group of infectious diseases.

Although it is not yet well established as to the channel by which the infective principle of Tuberculosis penetrates the organism, it is nevertheless not improbable that it enters by the respiratory, digestive, and genito-urinary passages; but it can only fix itself in organs already predisposed, and especially in those which contain stagnant, or nearly stagnant fluids, such as mucus, lymph, etc.

The irritant cause penetrates the finest lymphatic vessels, and is then gradually propagated. Very often the morbigenous agent

is isolated and enkysted, and the evolution of the morbid process is more or less delayed or completely checked.

To judge from clinical and anatomo-pathological facts, this irritant cause only occasions rapid death when the morbi-genous principle penetrates the blood circulation, which is exceptional.

"The *period of incubation* cannot, from a clinical point of view, be established, as the malady can only be recognised with great difficulty at its commencement. In 1867, I inoculated tuberculous cows with the pulmonary lymph derived from a cow affected with contagious Pleuro-pneumonia and Tuberculosis. Twenty-three days later, I found in the inoculation tumour real tubercles."*

There were *causes* for this disease, as beforetimes there were causes for the production of Glanders, Contagious Pleuro-pneumonia, and other morbid troubles. Ordinarily, these causes were sought for in the immediate neighbourhood of the diseased or suspected animal. Sometimes the pasturage, sometimes the stables, at other times the nature of the food (distillery grains, etc.) was blamed; in some instances other causes of the disease were put forward—such as certain functions more or less altered, as hypersecretion of milk, restricted sexual intercourse, etc.

Stirnimann,† who has carefully studied the disease in Switzerland, and has given a very exact description of it, states that when cattle were fed on marshy pastures the disease was much more frequent than at present, when they undergo a stable *régime*.

If this be a fact, it might be concluded that sour pastures, damp air, or marshy emanations, are the causes of the malady; but in order to explain the frequency of the affection in this case, we may also mention the *frequent chances of contact* permitted by depasturing cattle—chances which are considerably reduced by keeping cattle in stables.

According to Tessier,‡ the cause of the disease is to be found in the conditions created by newly-constructed cowsheds; and yet sheds similarly constructed to those in the infected localities have been tenanted by cattle which have not been affected by the

* "Receuil de Médecine Vétérinaire," September, 1868.

† "Schweiz. Archiv." New Edition, 1851, p. 17.

‡ "Observations sur plusieurs Maladies des Bestiaux." Paris, 1782, p. 105.

disease. Tessier had not in view the propagation of the malady by a contagium diffused in the sheds, as in his work he asserts that he only treats of those affections which are due to a vicious construction of dwellings. A number of morbid manifestations met with in animals, and which we cannot as yet otherwise account for, may otherwise be ascribed to the latter cause.

It is almost the same with regard to those causes which are qualified as occasional, for the reason, it is said, that the occasions for invoking and discovering them are never at fault.

All the older writers, besides, give as a cause of this malady a special disposition, which they attributed to an excess of nutrient fluid.

Veith was of opinion that the predominance of coagulable lymph in the blood became the cause of stagnations in glandular parts, and these stagnations determined the production of tubercular tumours in the serous and other cellular membranes containing much white blood. This opinion is still that which comes nearest to the ideas prevailing now-a-days. If he had known, as we now do, the irritant agent which originates the morbid process, and if he had attributed the advent of the disease to the action of this irritant, his interpretation of Tuberculosis would not have been very different from that generally accepted at present.

In the following chapter we shall prove that the bovine and porcine species, as well as rabbits, are predisposed to Tuberculosis. To express this fact in a word, these animals have a *constitutional predisposition* to this disease.

To explain this disposition, the idea has been entertained that the malady is more especially an affection of the lymphatic vessels and glands, as well as of the connective tissue and the serous cavities. The connective tissue in bovines, pigs, and rabbits is much more lax in structure than in the other domestic animals, and its meshes are larger, while the tissue itself is more abundant. These are conditions which were supposed to account for the tendency to fatten in pigs and cattle, animals in which this tissue is in such quantity in the lungs, that we can easily recognise the limits of the pulmonary lobules through the intact pleura. This laxity of tissues, and this kind of inferior organi-

sation, is met with in these animals, not only in the connective tissue, but also, in general, in the muscular tissue. Taking into account these facts, it is maintained that the connective tissue possesses lymph spaces, and particularly nutrient canaliculi, which, destitute of proper walls, establish a communication between the lymph and blood capillaries.

To keep the lymph in circulation in these channels, the intervention of muscles and elastic fibres of the connective tissue are considered necessary. As a consequence, therefore, of not only an abundance of connective tissue, but also its looseness and large meshes, as well as a relatively undeveloped muscular system, this tissue only receives an inconsiderable amount of pressure from the muscles, and there is, accordingly, a decrease in the circulation of the lymph, which frequently stagnates for some time between one point and another.

According to the researches of persons who are more particularly occupied in studying the lower organisms, among which we may mention Koch and Pasteur, stagnant or slowly-circulating fluids furnish a very favourable soil for the development of pathogenic proto-organisms. It therefore follows that the animals in which we find the fluids, such as the lymph or mucus, in a state of stagnation, are a very favourable soil for the action of these morbid causes.

However this may be, the predisposition to the morbid disturbance we are considering does not explain any more the development of this disease than the knowledge of occasional causes. Perhaps it will only be when we know the medical geography of Tuberculosis that we shall arrive at a conclusion on this subject, and may be brought to admit that it is due to only one cause, more or less prevalent everywhere, producing an effect essentially the same in all the animals submitted to its influence, though it may nevertheless present itself under somewhat different forms in its manifest expressions.

Tuberculosis is more especially developed in bovine animals, and is very prevalent among them, as we shall see presently.

The disease is met with wherever cattle are kept in a state of domesticity. It is seen in Russia, Sweden and Norway, in Denmark, Germany, Holland, Belgium, France, Spain, Portugal,

Austrian Hungary, Greece, Italy, Algeria, Australia, New Zealand, the Danubian Principalities, the Northern United States, and Canada; also in Mexico.* According to Krabbe, it is almost unknown in Iceland, and Stenstroöm states that it is very rare in Polar countries, in the north of Norway and Sweden, and in Lapland and Finland, where, nevertheless, the cattle are small and weak, and often rachitic.

The frequency of the disease increases as we approach warm climates.

The cattle of Holland and Switzerland often contract Tuberculosis when carried to Spain, and nearly all those sent from these two countries to colonies in the equatorial zone are attacked by the disease.

In Italy Tuberculosis is a veritable scourge to agriculture (Perroncito), and in Algeria it is not less prevalent than in Italy. According to Fleming,† it is becoming more common in England.

A cold climate is therefore less favourable to the development and propagation of Tuberculosis than a warm or tropical one.

We possess but little information with regard to the propagation of the disease during the past century. Graumann, in 1784, estimated at 4,000 to 6,000 thalers the damage annually caused by Tuberculosis among the cattle in Prussia, which was then only a small kingdom. About the same period, the meat inspector at Rostock had rejected, on the average, as unfit for consumption, the flesh of five cattle annually, or according to Graumann, one per cent. of the animals slaughtered.

It prevailed enzootically in the faubourgs of Paris during the years 1789, 1791, and 1794, and Huzard was charged to adopt the measures necessary to arrest its ravages. During 1791, it reigned in the arrondissement of Saarbourg, Lorraine, and at different times it caused much damage in the eastern departments of France.

* In "Veterinary Sanitary Science and Police," I have shown that in Mexico it is very common, and causes much loss, about thirty-four per cent. of the cattle slaughtered for food being found affected. The disease is also known in India, it being designated in Bengali *Jokkakas* and *Kyakas*.—G. F.

† "Tuberculosis," p. 11.

‡ "Traite sur la Phtisie Pommelière de la Bête Bovine." Rostock and Leipzig, 1784.

Hurtrel d'Arboval, from whose dictionary we have borrowed this latter information, estimated that in the circonscriptions of Brie, Beauce, and Caux, there was a tuberculous subject among every eight to ten head of cattle.

For the present century we have much statistical information with regard to its propagation, particularly that furnished by Wolf, Zürn, and Fischbach. Wolf states that in the environs of Leignitz, fifteen per cent. of the cattle are tuberculous. According to Zürn, it affects one-fifth of the bovines in the environs of Jena, in the circonscription of Eisenburg, and in the Duchy of Altenburg; while Fischbach states that $2\frac{1}{2}$ to 3 per cent. of all the cattle in the circle of Lower Taunus are diseased.

For Bavaria and the Grand Duchy of Baden in general, as well as for certain of the towns in these and other localities, we may refer to some precise details with regard to the cattle generally, and those for slaughter in particular.

According to the excellent abstracts prepared by Göring, on the Sanitary Condition of Animals in Bavaria, there were in that country in 1877 and 1878, respectively, 4,976 and 5,052 cattle affected with this disease; or, in 1877, 1·62 per cent., and in 1878, 1·61 per cent.

In 1,000 bulls	5·84	were tuberculous ;
„ bullocks	1·39	„
„ cows	2·50	„
„ heifers or stirks	0·35	„
„ calves	0·09	„

In 1877, of 4,976 cattle recognised as tuberculous, 64, or 1·31 per cent. were less than a year old; 328, or 10·81 per cent. were from one to three years old; 1,846, or 37·80 per cent. were from three to six years old; and 2,445, or 50·07 per cent. were more than six years old.

In 1878, the 5,052 tuberculous cattle were apportioned as follows:—

65	or	1·3	per cent.	were less than a year old ;
551	„	10·2	„	from one to three years ;
1,730	„	34·5	„	„ three to six years ;
2,360	„	46·5	„	„ more than six years.

For 336 animals the age was not noted.

Göring, in publishing this abstract, remarks that the veterinary

surgeons were not always informed as to the existence of the disease, and that the numbers given above must be considerably below the actual amount in any case. For more ample details in this respect, we have only to consult the *Deutsche Zeitschrift für Thiermedizin*, vol. iv. p. 281, vol. vi. p. 136.

Adam, in investigating the list of animals killed in the abattoir of Augsburg, arrived at the following results:—

In 1879, of 10,988 cattle slaughtered,	321, or 2·92 per cent. were tuberculous ;
„ 1880, „ 11,688	„ 262, „ 2·24 „ „
„ 1881, „ 12,500	„ 247, „ 2·00 „ „

According to Drexler, of 55,882 cattle slaughtered at Munich in 1875, 704, or 1·25 per cent. were affected with Tuberculosis in a very evident manner. Trapp reports that among 11,079 cattle killed in the Strasburg abattoir in 1880, 220, or 1·9 per cent. were tuberculous (this number did not include those slightly affected). For the same year, Mandel found 174, or 3·4 per cent. among 5,105 cattle slaughtered in the Mulhouse abattoir, and in 1879, Strobl and Magin recorded 1,125, or 2·5 per cent. of 44,699 slaughtered at Munich.

Taking into consideration the ages of the animals, the 1,125 were classed as follows:—

Cattle under one year	2, or 0·2 per cent. ;
„ from one to three years	81, „ 7·1 „ ;
„ „ three to six years	378, „ 33·5 „ ;
„ „ over six years	664, „ 59·2 „

The 1,125 tuberculous cattle may be also apportioned in the following order:—

218, or 1·13 per cent. of	19,284 bullocks slaughtered ;
558, „ 5·30 „	15,789 cows „ ;
40, „ 0·68 „	5,823 bulls „ ;
28, „ 0·73 „	3,803 heifers or stirks „ ;
1, „ 0·0006 „	149,971 calves „

From these figures, it results that:—

About two per cent. of the cattle sent to the abattoirs of these different towns are affected with Tuberculosis ;

The proportion of male to female animals so affected is as one to three ;

The greatest number of animals are more than six years of age ;

After these, the largest number is from three to six years ;

Very young animals are almost exempt from Tuberculosis.

We should fall into an error, however, if we attempted to deduce from these facts a direct conclusion as to the propagation and apportionment of Tuberculosis among cattle, as is proved by the figures given by Göring. According to these, there should be among the cattle 1·6 per cent. affected with the disease, but information gathered in the abattoir would show that there is a larger percentage among those killed for food.

It can easily be understood why the proportion of cattle recognised tuberculous at the abattoirs or after slaughter should be greater than that reported among cattle in general, as those sent to be slaughtered for food are more particularly calves, as well as cows or somewhat aged bullocks. Very rarely are steers or heifers seen at the abattoirs, and yet this complex group forms a large proportion of the bovine population—young cows, bulls, bullocks, and heifers constituting about 60 per cent. of the whole.

In the Grand Duchy of Baden, where every year a census is taken of the cattle, there are reckoned, in every hundred, seven calves, twenty-three young bullocks or heifers, thirty-four young cows under six years old, seventeen above six years, ten bulls, and nine oxen. The number of cattle in the Grand Duchy has been, for the last ten years, 600,000 head, not including calves older than four weeks, which are usually slaughtered for food. On the average, 113,000 cattle are annually slaughtered in the Grand Duchy—a little more than one-fifth, or 20 per cent. of all the cattle. This 20 per cent. is made up of calves, cows, oxen, and aged bulls, as well as of younger animals which are not considered fit for breeding purposes, milk production, or labour, and a certain number of others which can be conveniently slaughtered.

As comparatively old cattle furnish the largest contingent of tuberculous subjects, it should be admitted that these 20 per cent. of the bovine population, constituting the animals destined for food, *form a group in which Tuberculosis is much more frequent than in the remaining portion of the bovines*: in other words, *Tuberculosis is much less common in the general bovine*

population of a country than among the cattle sent to the abattoir.

The following statistics support this assertion:—

In the Grand Duchy of Baden, where the inspection of meat is carried out in all the communes, and where the inspectors furnish a quarterly report in a prescribed form to the district veterinary surgeon, in every 1,000 cattle killed eight are found tuberculous; in the communes in which the butchers' shops are almost exclusively supplied with the flesh of cows, the average number of tuberculous animals rises from eight to fifteen. These are the figures which correspond with the period from 1874 to 1880, and which are calculated on a total of 957,867 slaughtered cattle.

Of 1,000 cattle, the flesh of which was rejected as unfit for food, about one-half—430—were tuberculous. On the other hand, as is shown by the following table, there were only 2·2 per thousand, or 0·22 per cent., tuberculous cattle, which were—

- (a) Treated by veterinary surgeons ;
- (b) Killed in public or private abattoirs ;
- (c) Slaughtered by the owners in consequence of disease ;
- (d) Sent to the knacker when dead from disease.

The losses occasioned by Tuberculosis among the whole of the cattle in Baden are shown in the following abstract :—

Administrative District : Engen ...	...	0·07 per cent.
Constance ...	...	0·12 „
Messkirch ...	...	0·10 „
Pfullendorf ...	...	0·01 „
Stockach ...	...	0·11 „
Ueberlingen ...	...	0·23 „

Arrondissement of Constance 0·11 per cent.

Administrative District : Donaneschingen	...	0·11 per cent.
Triberg...	...	0·11 „
Villingen ...	...	0·03 „

Administrative District : Bonndorf	...	0·12 per cent.
Stickingen	...	0·16 „
St. Blasien	...	0·36 „
Waldshut	...	0·49 „

Arrondissement of Waldshut 0·31 per cent.

Administrative District : Breisach	...	0'15 per cent.
Emmendingen	...	0'03 "
Ettenheim	...	0'30 "
Freibourg	...	0'35 "
Neustadt	...	0'16 "
Staufen...	...	0'35 "
Waldkirch	...	0'11 "

Arrondissement of Freiburg 0'21 per cent.

Administrative District : Lörrach...	...	0'10 per cent.
Mulheim	...	0'13 "
Schönan	...	0'03 "
Schopfheim	...	0'07 "

Arrondissement of Lörrach 0'09 per cent.

Administrative District : Kork	...	0'06 per cent.
Lahr	...	0'04 "
Oberkirch	...	0'26 "
Offenbourg	...	0'11 "
Wolfach	...	0'24 "

Arrondissement of Offenbourg 0'15 per cent.

Administrative District : Achern...	...	0'15 per cent.
Baden	...	0'42 "
Bühl	...	0'18 "
Rastatt...	...	0'05 "

Arrondissement of Baden 0'15 per cent.

Administrative District : Bretten...	...	0'47 per cent.
Bruchsal	...	0'17 "
Durlach	...	0'66 "
Ettlingen	...	0'23 "
Karlsruhe	...	0'74 "
Pforzheim	...	0'62 "

Arrondissement of Karlsruhe 0'45 per cent.

Administrative District : Mannheim	...	0'45 per cent.
Schvetzingen	...	0'04 "
Weinheim	...	—

Arrondissement of Mannheim 0'13 per cent.

Administrative District : Eppingen	...	0'81 per cent.
Heidelberg	...	0'34 "
Sinzheim	...	0'28 "
Wiesloch	...	0'15 "

Arrondissement of Heidelberg 0'37 per cent.

Administrative District : Adelsheim	...	0·10 per cent.
Buchen...	...	0·21 „
Eberach	...	0·38 „
Mosbach	...	0·15 „
T. Bischofsheim		0·08 „
Wertheim	...	0·60 „
		<hr/>
Arrondissement of Mosbach		0·25 per cent.
		<hr/>
Grand Duchy of Baden		0·22 per cent.
		<hr/>

Although these numbers have been collected by competent public functionaries, we ought, nevertheless, to consider them as below the real figures, because, on the one hand, many owners of cattle do not send for the veterinary surgeon to attend every case of disease occurring among their stock, and many tuberculous animals are consequently not reported ; and, on the other hand, a certain number of animals are, notwithstanding all the regulations in force, concealed from the meat inspector, after having been killed while *in extremis*, or they are considered as affected with Tuberculosis when they are not really so. For the Grand Duchy of Baden, we shall not be far from the truth if we admit, as the approximate number of cattle affected with the disease, as double that given above—that is, 0·45 per cent.

As in Baden the number of cattle affected with Contagious Pleuro-pneumonia has only, during the years 1874 to 1880, attained the proportion of 0·01 per cent., and as it is the same with anthracoid affections, it may be admitted that the losses caused by Tuberculosis among cattle in the Duchy are at least twice the number of those occasional by Contagious Pleuro-pneumonia and Anthrax combined.

The table which shows the prevalence of Tuberculosis proves that the disease is not equally spread in the different districts, and it would be interesting to learn why it is infrequent in some of them.

According to Zippelius,* Tuberculosis is most frequently developed in deep and narrow valleys, or in densely-populated localities surrounded by walls. The disease causes greatest ravages in damp and dark dwellings, built against hill-sides, and constructed of freestone.

* “Wochenschrift für Thierheilkunde und Viehzucht,” 1876, p. 189.

The frequency of the affection decreases and increases with the condition or means of the cattle-owners, the cowsheds of the poorer owners being often very badly constructed.

The disease is rare, on the contrary, in localities where the habitations are roomy and situated on elevated ground, exposed to the winds. In these localities the disease is less frequent, because the dwellings are often built of boards or laths, which allow free access of air.

In the Obernbourg district, where the above conditions are realised to a high degree, among the cattle slaughtered during the last six years not one has been found affected with Tuberculosis; and yet the district contains 1,637 head of cattle.

If we are to judge from Göring's abstracts, the same differences in the frequency of the disease exist in the districts of Bavaria.

For instance, the losses caused by Tuberculosis in every 1,000 cattle are distributed in the following manner:—

In 1878,	2·20;	and in 1877,	2·45,	in Upper Bavaria;
„	1·80;	„	„	0·75, in Lower Bavaria;
„	2·25;	„	„	2·30, in Palatinate;
„	1·20;	„	„	1·22, in Upper Palatinate;
„	0·84;	„	„	0·97, in Upper Franconia;
„	1·06;	„	„	0·94, in Middle Franconia;
„	2·43;	„	„	2·30, in Swabia.

Göring completes these statistics in adding that in the part of the country inhabited by the uni-coloured mountain cattle, Tuberculosis is most frequent, because of the large number of cases of the disease in the districts of Weilheim, Kempten, Krumbach, and Mindelheim, where the dairies are numerous and important, and where continual importations of new milch cows occur.

In speaking of Tuberculosis in the Palatinate, this practitioner expresses himself in the following terms:—“A part of the great frequency of the disease in the Palatinate belongs to the districts of Frankenthal, Germersheim, Kaiserslautern, Kirchheim, Landau, Neustadt, and Spire—all districts into which a large number of cattle are brought either for milk production or to be fattened. On the contrary, cases of this disease are rare in those districts where the Glan breed of cattle predominates, as in the circles of Kusel and Hombourg—breeding districts into which very few animals are imported.”

In Baden the affection is most frequently met with in the neighbourhood of large towns ; it is much less common, or is almost entirely absent, in hilly or mountainous parts. In certain regions where cattle are kept almost exclusively for breeding, Tuberculosis is nearly unknown, as in those in which are raised the Hinterwald cattle (Schönau, Lörrach, and environs), and in the administrative districts of Pfullendorf and Messkirch. Up to the present time these districts have also remained free from Contagious Pleuro-pneumonia, while those which were previously frequently visited by the latter malady are the ones that now have numerous cases of Tuberculosis occurring in them.

These differences do not appear to depend altogether upon the nature of the soil, altitude, methods of cultivation, or conditions of comfort: the latter do not seem to intervene here, only in so far as they are favourable or unfavourable to the breeding of cattle. If in consequence of these conditions farmers adopt cattle-breeding, they produce not only sufficient for local demands, but also for those of commerce, and are thus regular exporters without being required to import. If the local conditions are, on the contrary, unfavourable to breeding, the agriculturists procure the cattle they may require from without ; consequently, changes are frequent among their stock.

Contagious diseases in general, and Tuberculosis in particular, are very infrequent in habitations to which strange cattle are not admitted, and where vacancies are filled up by the home stock.

Veith, in his writings, states that Tuberculosis is not met with in animals which live in a wild condition, nor even in those which are in a semi-savage state. Spinola confirms this statement, and adds that the affection is unknown in the Russian steppes, and is rare in elevated regions.

Does not Tuberculosis, in all these points, call to mind the etiological history of Contagious Pleuro-pneumonia ?

Absolutely the same ideas have prevailed, relative to the causes of Contagious Pleuro-pneumonia, at the time when its contagiousness was still a matter for doubt. The marked hygroscopic condition of low-lying countries ; damp pastures ; bad food ; unhealthy stables ; over-crowding ; feeding on the refuse of breweries, distilleries, and sugar-factories ; too rapid

fattening; and excessive lactation—all these were looked upon as the essential causes of this malady up to nearly the time when it was at last recognised that its greater frequency in low-lying damp countries, in dairies, distilleries, breweries, and sugar-works, than in elevated countries and breeding farms, is due to the fact that in the first-mentioned regions and habitations the bovine population is being continually renewed, and that the opportunities for the introduction of infected or diseased animals are consequently much more frequent than in stock-raising countries.

The number of cattle attacked with Tuberculosis is considerable, even if we take into account only those sent to the abattoirs—those places where animals are only valuable for the materials their carcasses yield. It is otherwise, however, with the cattle employed in labour, and those for production and reproduction which are traded in. Numerous tuberculous animals are sent to the ordinary fairs and markets, where they come in contact with healthy cattle. To prove this latter fact, we shall find materials in the statistics of actions-at-law, in the matter of Tuberculosis, recorded during the years 1867 to 1882 as having been entered upon in the Grand Duchy of Baden. The following are the figures:—

YEAR.	Total of Civil Actions on account of Unsoundness.			Total of Civil Actions on account of Tuberculosis.			In 100 Civil Actions, there were on account of Tuberculosis,	
1867	337	...	...	237	...	70'3
1868	348	...	...	247	...	71'0
1869	442	...	...	305	...	69'0
1870	279	...	...	169	...	67'0
1871	418	...	...	293	...	69'0
1872	710	...	...	512	...	79'7
1873	646	...	...	511	...	79'1
1874	486	...	...	368	...	75'7
1875	342	...	...	253	...	79'3
1876	330	...	...	219	...	66'0
1877	505	...	...	395	...	78'0
1878	655	...	...	478	...	72'9
1879	470	...	...	316	...	67'2
1880	238	...	...	155	...	69'0
1881	214	...	...	112	...	59'3
1882	309	...	...	140	...	45'3

Although up to 1879 fifty-five per cent. of the cases of unsoundness had not been established through the intervention of veterinary surgeons, and that since then it has been the same for

forty-five per cent. of the cases mentioned, the figures given already prove that a good number of the cattle dealt in and carried about are affected with this disease ; and the number must be very much greater when we reflect that all the phthysical cattle do not become the cause of a law-suit.

It is not only in cattle that we meet with this malady ; it also attacks other creatures, and of these we place the *pig* in the first line. In this animal we find the lesions of Tuberculosis in or on the serous membranes, as well as in the pulmonary parenchyma (Pulmonary Phthisis), where it assumes the form of small nodosities or caseous infiltration. The lesions of the affection may also, in the pig, become localized in the mucous membrane of the small intestine, as a caseous degeneration ; but they are more frequently met with, in this animal, in the lymphatic glands, where they give rise to the formation of soft or caseous centres, of the consistency of mortar, disseminated or deposited in mass in the tissue. When the malady is more especially localized in the lymphatic glands, it is then known as Scrofula. To judge from what has been stated by the best observers, it is more particularly highly-bred animals—those with fine and abundant connective tissue and small bones—which are attacked with Tuberculosis in the latter form ; while the ordinary unimproved breeds are much seldomer affected.

Spinola, Albrecht, Roloff, Schütz, and Semmer have studied this affection in North Germany and Livonia ; Bollinger has observed it in Switzerland, Trasbot at Alfort, Mandel in Alsace, and the majority of Badenois veterinary surgeons in the Grand Duchy of Baden. Leisering has noted the presence of the disease in a wild boar in the Zoological Gardens of Dresden ; and Göring reports that, in an establishment where there were many tuberculous fowls, he found a score of pigs affected with Scrofula or Pulmonary Phthisis.

In the Grand Duchy of Baden there were killed, during the period between 1874 and 1882, a yearly average of 7,800 pigs, and of these twenty-two were affected with Tuberculosis—a percentage of about 0·2 of all the pigs slaughtered. It must not, however, be concluded from these figures that this disease is

very rare among pigs in the Grand Duchy ; for in order to be fit for the butcher the pigs ought to be fat, and the number of those which are capable of being fattened when attacked by Tuberculosis is inconsiderable. Those which cannot be fattened are slaughtered clandestinely or sacrificed *in extremis*, and their flesh is generally employed in the manufacture of sausages.

In the report on the sanitary condition of the domesticated animals in Saxony during the year 1881, Baumgärtel describes a typical case of Pulmonary Phthisis observed in a pig. The lungs, as well as the spleen and liver, were full of tubercular nodules, as were also the lymphatic glands. On the costal pleura there were nodules as large as a pea, of the same character as those met with in bovine Tuberculosis. A somewhat numerous list of similar cases may be made from the writings of different veterinary surgeons.

The existence of this disease in the *sheep* is not yet well established. The description of ovine Tuberculosis in the writings of Hurtrel d'Arboval* does not allow us to decide whether he really had to do with this malady, Distomatosis, or some other chronic affection. The publications of Dupuy, Baron, Delafond, and Lafosse, on Pulmonary Phthisis in the sheep, leave us in doubt as to the nature of the affection alluded to, as well as to the character of the pulmonary nodules, nodosities, and other lesions observed in the course of the disease. According to the researches of Villemin, Röhl, and Damman, sheep are refractory to tubercular inoculation ; while Colin and Zürn pretend that, although the majority of their inoculations were without result, they nevertheless sometimes succeeded in communicating the disease to these animals.

Carsten Harms relates the occurrence of Tuberculosis in a *goat*. In making the autopsy of this animal, he found nodules and vomicæ in the pulmonary parenchyma, the former being of the size of a grain of millet to that of a pea. On the surface of some sections the nodules were grey in colour, moist and shining ; while others were dull and had a yellow tint. With regard to

* Dictionnaire de Méd. Vétérinaire, vol. v., p. 49, Paris, 1839.

the caverns, their dimensions varied from that of a hazel nut to a fowl's egg ; their walls were irregular, but smooth on the surface, and a certain number had cords or bands across them. The smallest were completely closed, and contained a grey grumous mass ; the largest communicated with the bronchi, and likewise contained a greyish-brown coloured mass, but which was mixed with air.*

We (Lydtin) have met this Phthisis in three goats at Baden-Baden. These animals belonged to a large flock, and were housed with cattle belonging to the same owner. The cattle were often renewed, and here and there amongst them cases of Tuberculosis occurred. The diseased goats gradually became emaciated, and they coughed ; the visible mucous membranes and places destitute of hair became pallid ; the secretion of milk diminished to such an extent that it was not worth drawing. After death, in all three goats the lesions were confined to the chest. The pulmonary interlobular connective tissue was increased, and in the substance of the lungs were found nodules and nodosities ; the visceral pleura was, like the parietal, also studded with similar neoplasms, some of which were attached by a long pedicle.

Gerlach reports a doubtful case of miliary Tuberculosis of the lungs, observed in a goat ; and Paulicki has noticed Pulmonary Tuberculosis in *deer* and *gazelles* in a zoological garden.†

With regard to the existence of this disease in the *horse*, Gerlach declared that he had only known of four cases of Tuberculosis in this species. The neoplasms found were in the form of fibrous tubercles, and were situated in the lungs and on the pleura ; they resembled the pathological products of bovine Tuberculosis.

Professor Gotti reports, in the *Journal of Anatomy of Pisa* (1872), the following cases, which belong to the subject now occupying us. The description of these cases is not sufficiently explicit as to their nature, but it is very interesting, nevertheless ; it was republished in German by Müller and Röhl.‡

* Badische Thierarzt Mittheilungen, 1871, p. 96.

† "Fleischkost des Menschen." Berlin, 1850.

‡ "Oesterreich-Vierteljahresschrift für Wissenschaftlich Veterinärkunde." Vol. xxxix., p. 61.

"In opening the carcase of an emaciated horse, there were found on the peritoneum numerous nodosities of various sizes, grey or milky-white in colour, and of a fibrous aspect. Some of these nodosities were directly fixed on this serous tunic, the others were adhering to it by means of filaments of connective tissue. The mesenteric glands were indurated, and all the lymphatic vessels visible. The mediastinum and costal pleuræ were equally covered with nodosities, but these were less abundant than in the chest. One portion of the pulmonary parenchyma presented the lesions of red hepatization, and was full of small purulent foci. Some of the nodosities were hard in their peripheral portions, but softened and transformed into a yellowish mass in their centre. The substance of these nodosities was constituted, according to Gotti, of fusiform cells, giant cells, free nuclei, and a yellow and friable yellow detritus; cretification was rare."

In another case, Gotti only found the nodosities in the chest and on the urinary organs—especially in the walls of the bladder, in the ureters, and the kidneys. Besides the authors above quoted, Tuberculosis has also been noted as existing in the horse by Bruckmuller,* St. Dizier,† Leblanc,‡ Kolb and Hager,§ etc.

Although Dr. Croq,|| then prosector of Anatomy at the University of Brussels and now professor there, speaks of Tuberculosis in the horse, in a work on auscultation and percussion in their application to the diseases of the thoracic organs, we may justifiably inquire whether this was not a case of Glanders.

Certain authors categorically deny the existence of Pulmonary Tuberculosis in the horse.¶

The *rabbit* is, as many experiments prove, very disposed to contract this malady. The nodosities are, in this animal, as a general rule, constituted by a semi-fluid, puriform mass, contain-

* *Ibid*, 1860.

† "Journal de Méd. Vétérinaire," 1864.

‡ "Recueil de Méd. Vétérinaire," 1865.

§ "Der Thierarzt."

|| "Centralzeitung für die gesammte Veterinarmedizin," 1853, p. 157.

¶ Cases of so-called Phthisis pulmonalis in horses are frequently reported in English veterinary literature, but it may reasonably be doubted whether they are not cases of chronic Glanders. In all the cases I have seen in which *miliary tubercles* were found in the lungs, these neoplasms had not the characters of those of Tuberculosis, but rather of Glanders.—G. F.

ing a little caseous matter in suspension; the rapid cretification noticed in the horse in analogous lesions is not met with in the rabbit. This difference in the constitution of the nodosities again proves that the characters of the tubercle neoplasm are dependent upon the nature of the soil in which it is developed, and that its characters differ not only according to the tissue from which it proceeds, but also according to the individuals in which it is developed and the species to which they belong. It therefore follows, that if we are not willing to consider their macroscopic and microscopic characters, we ought to distinguish fibrous and sarcomatous tubercles, and tubercles of man, ox, rabbit, etc.

Among the other animals in which Tuberculosis has been found, though rarely, may be mentioned the *dog* (Göring, Peroncito, Roustan, Ercolani, and Klebs); *cats* (Bollinger and Toussaint); caged *lions* (Gerlach and Hering); *kangaroos* (Paulicki, Schmidt, Peroncito); and especially in *monkeys*, in which, for a very long time, this affection has been noted by physicians and veterinary surgeons.*

Poultry may also contract the disease, the neoplasms developing more particularly in the pulmonary tissue, liver, ovaries and bones.† Göring found thirty tuberculous fowls in one establish-

* It may be questioned whether monkeys die so frequently from Tuberculosis as is generally supposed. Mr. Sutton points out that in the gardens of the Zoological Society of London, previous to his attendance, it seemed to have been the custom to employ the word tubercle or Tuberculosis in a generic sense, including in the term all such affections as Pneumonia (lobar and lobular), empyema, abscess, caseous glands, and the like. Hence, possibly, the origin of the error regarding the frequency of Tuberculosis. From December 1st, 1881, to March 30th, 1883—an interval of sixteen months—110 quadrumana died, and he personally examined the viscera of ninety-three, with the result of finding tubercle in three only. Two of the cases were Rhesus monkeys from India, and the third a Vervet monkey. The disease, he adds, was unmistakable: tubercular Phthisis associated with cavities in the apices of the lungs, in every point resembling the condition met with in the human subject. There were also three cases of Scrofula.—*Diseases of Monkeys*, VETERINARY JOURNAL, October, 1883, p. 253.—G. F.

† See an article on Tuberculosis in Fowls, by Dr. Ribbert, in the "Deutsche Medizinische Wochenschrift," 1883, VETERINARY JOURNAL, September, 1883, p. 189. At a meeting of the Pathological Society of London, held in November, 1883, Mr Sutton read, in conjunction with Dr. Heneage Gibbes, a first paper on the so-called "Tuberculosis" in birds. He said his attention was first attracted to this disease in the spring of 1879 by a farmer in the north of Middlesex, who had sent him two dead fowls, stating that disease had broken out among his poultry, and that his stock of birds stood a fair chance

ment, and he attributed the contamination in this instance to be spread through the medium of the cock.

Inquiry into the existence of Tuberculosis among the different species of domesticated animals, demonstrates a fact worthy of notice, namely, that creatures kept through domesticity in the immediate vicinity of man, or confined in stables, sheds, or cages, are those in which the disease is most frequently encountered. Therefore it is that we find it oftenest in cows and pigs, and especially those of improved breeds which are not allowed to pasture, in the mammalia of zoological gardens, and poultry confined in pens. Animals which live in a state of liberty, or are often allowed to go out in the open air, as horses and sheep, are either seldom affected or are altogether exempt.

Tuberculosis resembles those other infectious maladies which, like it, become readily domiciled, and exercise their ravages in badly-ventilated places where the air stagnates, and where, it

of annihilation. By thoroughly destroying the bodies of the dead birds, and killing the sickly ones, the disease seemed to be arrested for a time. In 1881, the disease again made its appearance, and nearly all the offspring of the stock of 1879 died. Ducks and geese were not affected in either epidemic. In the latter part of that year, Mr Sutton commenced work at the Zoological Gardens, where, in the course of his dissections, he found the disease very prevalent. After spending more than two years in investigating this matter, examining from all sources more than 1,000 birds of various species, he proposed to put the results of his observations before the Society under three headings: (1) The anatomy of the disease; (2) its zoological distribution; (3) the histology of the affected organs. 1. The disease first manifested itself in the alimentary canal in the form of yellowish-white nodules, varying in size from a small pin's head to a mass as large as a chestnut. They projected most into the interior of the bowel, thus causing death by obstruction, or projected on the serous surface, setting up Peritonitis. The liver next became the seat of caseous nodules, equally disseminated throughout its substance, at first very minute, but soon attaining a considerable size. The spleen rarely escaped, frequently being so full of these nodules that the capsule ruptured. The lymphatic glands in the neck were affected in severe cases. The mesentery often contained nodules, due to the collection of the morbid material in the ducts leading to the receptaculum chyli. The kidneys, heart, etc., were rarely the seat of gross lesions. Once a deposit had been met with in the lungs. Death was nearly always caused by the mechanical effects of the nodules in the intestines, producing obstruction or setting up Peritonitis. 2. The birds almost exclusively affected by this disease were those which live on seed, grain, and fruit (by grain is meant barley, maize, oats, etc.) Twice it had occurred in flesh eaters, but no case had been met with in those subsisting on fish. The struthiones, particularly the rhea (South American ostrich) were very liable to this affection. The birds most liable were common fowl, peacock, grouse, guinea-fowl, tragopan, pigeon, and partridge.

may be said, the animals rarely move beyond the vaporous zone which they are constantly contaminating.

The principal fact arising from what has now been stated, is that *Tuberculosis is, of all the maladies affecting the domesticated animals, that which is the most wide-spread, and which, of all others, most deserves the qualification of universal panzooty (Weltseuche).*

It has been considered that this somewhat extended preliminary review of the symptoms, lesions, causes, and propagation of Tuberculosis, must necessarily precede the real questions brought for discussion before the Congress, if it were really desired to treat these in a thorough manner.

FIRST QUESTION.

What is the influence of heredity on the propagation of Tuberculosis?

From the earliest times, the hereditary nature of Tuberculosis has found its adherents and its adversaries. To modern science is due the credit of occupying itself seriously with this question.

Possibly the two flesh-eating birds contracted the disease by eating birds affected with the disease. 3. In July, 1883, Mr. Sutton took counsel with Dr. Gibbes, who submitted specimens of the organs of the rhea, peacock, tragopan, and golden pheasant affected with Tuberculosis, to microscopical examination, with the following result :—Sections of the liver, when stained with logwood, showed circumscribed areas surrounded by fibrous tissue, in which were numbers of cells which appeared to be disintegrated. Among them were numbers of small cells which stained deeply. Outside these areas the liver appeared to be normal. On staining sections especially for bacilli, the whole of the circumscribed areas before mentioned were found to be made up of cells filled with bacilli. These bacilli were in cells varying in size, and also arranged in tubular masses in what appeared to be vessels. They had the same reaction to staining agents as the bacilli found in Tuberculosis; with a high power ($\times 4000$) they were undistinguishable from them; they also contained rounded bodies resembling spores. Bacilli were also found in the lung and lymphatic glands of the peacock, in the lymphatic glands and liver of the tragopan, and in the lung, intestine, liver, and spleen of the golden pheasant. With regard to transference of disease from man to animals, it may be said that on the farm originally watched some pigs had died of "tubercular" Peritonitis. These pigs were fed on the refuse from the kitchen, including the offal from the poultry. At the Zoological Gardens two carnivorous animals, an eyra from Brazil, and a paradoxure from India, died with their livers in the same condition as tuberculous birds. These creatures were fed on small birds and the offal of poultry. Their livers were examined by Dr. Gibbes, who found the nodules contained bacilli, giving the same reaction to staining agents as those found in the nodules of birds' viscera.—G. F.

The older observations relative to the heredity of Tuberculosis were based chiefly on the fact that calves and young pigs, the progeny of parents affected with the disease, sooner or later contracted it. An example of this is given *in extenso* in an encyclopedia of rural economy, by Dr. Krunitz, in 1878,* and the following are the observations with which he terminates his remarks :—" After having sustained considerable losses for many years, owing to the employment of phthisical animals for breeding purposes, the owner referred to got rid of the scourge which had for so long ravaged his cowsheds, by selling his bulls, and gradually ceasing to breed from the cows which, until then, had been used for this purpose."

Numerous analogous cases are to be found in the veterinary journals of Switzerland, Germany, France, England, etc. In every case brought forward in recent times, it has not been positively established that the animals which became diseased had inherited the malady from their parents, and that they had not contracted it after birth, as Bollinger thought. To prove, from a scientific point of view, that heredity is operative in such cases, it should be demonstrated that at birth the foetus or new-born animal is already diseased, and that, consequently, infection must have been conveyed either to the ovum or the embryo (congenital or congenial transmission).

In these cases, infection might have occurred at different periods of ovular evolution or intra-uterine life. The spermatic fluid might infect the ovum---the infection being most probable if the secretory or excretory organ of that fluid is charged with the contagious principle. The ovum may also become infected through the intervention of the mother, and thus infection may take place *before*, or even *after*, fecundation, if the ovaries, oviducts, or the uterine mucous membrane, are the seat of Tuberculosis.

It may also be admitted that a healthy ovum, fecundated by spermatic fluid equally healthy, is normally developed during the first, second, third, or fourth month, or even longer, and then becomes infected through the blood of the mother. If this

* "Encyclopädie oder allgemeinen System der Staats-Haus und Land wirthschaft," Berlin, 1878. Heft XIV., Seite 751.

infection takes place only a few days before birth, the new-born creature, although apparently enjoying perfect health, is nevertheless in the incubative stage of the malady, which will not be slow to manifest itself.

When the ovum is infected by the father or mother, it does not become developed, or its development is of short duration. In such a case, coition will be unfruitful, and if the infection is due to the mother, she will be rendered completely sterile. If the foetus is infected during its development, it usually becomes diseased and perishes before birth, being generally expelled from the uterus by abortion.

If infection does not take place until the foetus is perfectly mature, birth may take place in a regular manner; but the young animal will soon show signs of the disease, and if it is placed in unfavourable conditions it will succumb rapidly.

These different suppositions are quite conformable to the facts which we have ourselves observed in animals affected with Tuberculosis. It is recognised that a large number of phthisical animals only exceptionally breed, or they remain totally sterile; and this absence of the procreative faculty has been indicated by many authorities, and especially by Roloff, as one of the symptoms of Tuberculosis.

It is equally a matter of general notoriety that abortion is very frequent in phthisical cows. The reports published by Göring, Adam, Röbl, and Magin, with regard to the number of tuberculous calves met with at the abattoirs of Bavaria, and particularly those at Augsburg and Munich, prove that the birth of a phthisical calf at full time is a rare fact.

Among an average of 160,000 calves examined by the inspector at the Munich abattoir,

In 1878 there were 2 cases of Tuberculosis

„ 1879	„	1	„	„
„ 1880	„	0	„	„
„ 1881	„	0	„	„
„ 1882	„	2	„	„ *

These figures compel us to admit that the majority of the infected ova perish at the commencement of their evolution, and that a great number of embryos succumb *before* their complete

* Personally communicated by H. Röbl.

development, and are either expelled, or undergo decomposition in the uterus in the form of ichorous destruction, or mummification. A small number of foetuses derived from infected ova are aborted, and a still smaller number are born under normal conditions. Among the new-born, at full time or before it, there may be some which have been infected only a short time before birth, and others which have been contaminated for a more or less longer period—even in the ovum—and which, notwithstanding, do not manifest any morbid symptoms after birth; far from dying from the disease, they may be lively, thriving, and so strong that they grow as if they were in a normal condition.

Tuberculosis is recognised to be an essentially chronic disease, but not absolutely fatal; many animals are affected with it during their whole life. If the morbid principle does not attack an organ essential to vegetative or animal existence, the animal may render all the services of one which is in a good state of health; it may produce calves, furnish milk, perform labour, and even become fat. If the centre of infection is very limited, encysted or isolated, calcified or cretified, the animal will enjoy relatively good health, and perform its functions as if perfectly well.*

It is probably the same with the embryo as with young and adult animals: it may resist the action of the morbigenous cause, become developed, and even reach maturity, notwithstanding the presence of a centre of infection, which, however, remains circumscribed. This is more likely to happen if the infected organ is not very important, or the centre is encysted.

The heredity of the silkworm disease, known as *Pebrine*, presents a certain analogy with that of Tuberculosis. In this affection, the virus, in the form of a microscopic fungus, is also met with in the ova, where it arrives by way of the ovaries.

The germinative faculty of many of the ova is destroyed by this fungus; but a certain number, though infected, become developed and produce silkworms, which may attain the chrysalid form, and even become perfect insects, growing new ova which the parasite soon infects. The selection and destruction

* See a remarkable case by Jessen, in the "Wochenschrift für Thierheilkunde und Viehzucht," 1872.

of infected ova are the means employed to free sericulture from this contagious affection.

We may, then, admit that animals which were already infected, when in the state of ovum or foetus, may not only live and develop, but grow and multiply, and thus play a considerable part in the propagation of certain maladies. Some clinical facts support this view, and are favourable to the opinion as to the transmission of Tuberculosis from parents to offspring, or conveyance of infection to the ovum or foetus.

König,* a district veterinary surgeon, reports that he has, on several occasions, found on the stomach and omentum of calves, six to eight days old, small fleshy excrescences which (he states) become tubercles. Veterinary Surgeon Stirnimann† has sometimes noticed very young calves affected with Tuberculosis.

Adam,‡ of Augsburg, relates an instance, from among many others, in which the lesions of the disease were observed in a calf which died a few hours after its birth, the cow being at the time affected with Tuberculosis. The cow was seven years of age, medium-sized, and examined soon after purchase. There was a frequent and difficult cough, friction sound heard on auscultation of the thorax, with dulness on percussion, and general emaciation and hectic fever—all indications of the presence of Tuberculosis. Two days before, this cow had given birth to a very emaciated calf, weighing scarcely twenty-five pounds, and so weak that it could scarcely stand. The cow and calf having died in forty-eight hours, they were both examined *post-mortem*. The carcase of the cow showed general anæmia; on the serous membrane of the chest and lungs were the well-known excrescences from the size of a pea to that of a fowl's egg, partly grey or yellow-tinted with red, fleshy in appearance and soft in consistency, partly yellow, solid, and cretaceous. The pulmonary parenchyma was studded with an infinite number of variable-sized tubercles, some soft, others rather firm; a certain number had undergone caseous transformation, others

* "Magazin für die Gesammte Thierheilkunde." Jahrgang, 1853, 3tes Heft.

† "Schweiz-Archiv für Thierheilkunde." 1851, Band XI., s. 19.

‡ "Wochenschrift für Thierheilkunde und Viehzucht," 1857, p. 53.

calcareous infiltration. With the calf the muscles were, as in the cow, discoloured, flabby, and infiltrated with serosity; all the tissues were anæmic; the pericardium contained about 100 grammes of yellowish transparent fluid, and on the peritoneum, in the vicinity of the right kidney, were five pale-red and soft excrescences, the volume of which varied from that of a bean to that of a hen's egg. Adam adds: "Although it is very rare that Tuberculosis commences during fœtal life, yet it is notorious that a tuberculous cow transmits to its descendants a predisposition to the disease. The above fact is a fresh proof of the transmissibility of this malady, and should be a caution to breeders to be very circumspect in the selection of breeding stock."

The following facts are also offered in support of the heredity of Tuberculosis :—

In the *Wochenschrift für Thierheilkunde und Viehzucht* (vol. xxii., No. 20), it is mentioned that a tuberculous calf was found in the abattoir of Nuremburg in 1878; and in the same journal for 1878 (No. 6), and 1881 (No. 13), it is reported that five tuberculous calves were killed at the Augsburg abattoir.

On March 27th, 1880, District Veterinary Surgeon Butscher, of Bruck (Upper Bavaria), showed the tuberculous lungs of a sucking calf at one of the meetings of the Munich Veterinary Association.

Virchow mentions the existence of Tuberculosis lesions in the ovary and Fallopian tubes of a calf.

Semmer relates five cases of pulmonary Tuberculosis he met with in fœtuses of cattle. In the first of these cases, he remarked several small nodules in the lungs of a three-months embryo, aborted by a tuberculous cow. These nodules consisted of aggregations of spherical and fusiform cells, with filamentous ramifications. The second case was that of a six-months' fœtus, also aborted by a tuberculous cow; in this fœtus the lungs showed numerous white points or nodules, some the size of a pin's head. These had the appearance of round-celled sarcomata, the cells in some places being so matted that the connective tissue appeared to be completely absent; these masses of cells might be considered as the point of departure of a

tubercular formation. The third case was a foetus of eight months, from a tuberculous cow; the lungs contained isolated nodules larger than in the two preceding cases, though analogous to them in structure. The two last cases were new-born calves from diseased cows; their lungs were full of nodules of various sizes and in different degrees of formation, some being in the earlier stages and others already caseified or calcified. In terminating his report, Semmer says:—"These five cases sufficiently prove that Tuberculosis may be developed during the embryonic period, and that it is readily transmitted through heredity."

Jessen found the lungs of an aborted bovine foetus, three months old, full of recent tubercles.

At the eighteenth general assembly of the Grand Duchy of Baden Veterinary Association, held at Fribourg in 1882, Fischer of Wolfach mentions the fact of a heifer, a bull, and a calf, sixteen days old, all standing in a stable at Birkendorf, and the produce of a tuberculous cow; the three were attacked by this disease, the lesions of which were found in the mother. Fischer made special mention of the calf's lungs containing a mass of grey and yellow miliary tubercles.

Müller* bought a calf derived from a tuberculous cow, which on being slaughtered, showed the lesions of Tuberculosis; more especially were they located on the serous membranes, and in the form of disseminated tubercles in the lungs. The calf was kept for two months at the Vienna Veterinary School, and fed on healthy milk; it was then killed. At the autopsy, Korzil found on the costal pleura several nodules the size of a grain of millet to that of a hemp-seed; these were white and soft. Similar nodosities were also found on the pulmonary pleura; the bronchial glands were increased in size, generally consistent in texture, and when cut a small quantity of fluid escaped, while the cut surface was greyish-white in colour. The parietal pericardium was covered with excrescences, and the great omentum contained tubercles. It was the same with the mesenteric as with the bronchial glands, they being tumefied and in several places

* "Oesterreichische Vierteljahresschrift für Wissenschaftliche Veterinärkunde," 1879, p. 64.

transformed into a whitish-yellow caseiform mass. In the parenchyma of the liver were caseous nodules, and the lymphatic glands, greatly increased in volume, had undergone caseous degeneration. The spleen was tumefied and full of tubercles. A microscopical examination left no doubt as to the tuberculous nature of all these pathological lesions.

Müller concluded, from all these facts : 1st, That this disease is Tuberculosis ; 2nd, That it is transmitted from mother to progeny, and that the latter from the moment of birth may possess not only the predisposition, but even present the patent lesions of the malady.

A remarkable case, proving the transmission of the disease from the male parent to progeny, is published by Zippelius.* A stock-breeder, who for more than twelve years had not witnessed a case of Pneumonia among his cattle, purchased a bull in the Simmenthal, and put it to ten of his cows. The bull was found to be affected with Tuberculosis, and for this reason was killed. All the calves of the ten cows which had been put to this bull, and which could be kept under observation, had eventually to be slaughtered because of this affection. The first symptoms of the disease in the calves were manifested when they passed to adult age.

Farther proofs of the heredity of Tuberculosis may be found in the writings of various veterinary authorities, and especially in those of Chauveau,† König and Eberhardt,‡ Adam and Ott,§ Köhler and Hetjemeier,|| Esser, Kühnert, Hagen, Ulrich, Schanz,¶ Rychner,** Scholtz, Röttinger, Kolb, Fischback,†† Semmer,‡‡ etc.

In the *Deutsche Zeitschrift für Thiermedizin und Vergleichende*

* "Wochenschrift für Thierheilkunde und Viehzucht," 1876.

† "Recueil de Méd. Vétérinaire," 1873, p. 979.

‡ "Magazin von Garlt und Hertwig," Band XIX., XXXIX.

§ "Wochenschrift für Thierheilkunde," Band XX., s. 38 ; XXI., s. 61 ; XXII., ss. 41, 265 ; XXV., s. 107.

|| "Repertorium für Thierheilkunde," 1846, s. 197 ; 1857, s. 151.

¶ "Mittheilungen aus der Thierarz." Praxis in Prusse. Band VIII., s. 182 ; XV., s. 81.

** "Encyclopédie," 1837.

†† "Mittheilung. au der Thierärz Praxis im Preuss." Band II., ss. 101, 103 ; VI., s. 13.

‡‡ "Oesterr. Vierteljahr. f. Wissen. Thierheilkunde." Band IX., s. 10.

Pathologic (IV., 289), Göring remarks that in nearly all the reports for the year 1877, the veterinary surgeons in Bavaria concluded, almost without reserve, that in the 123 cases of Tuberculosis reported hereditary transmission was in operation, transmission being more especially marked on the side of the cow ; though in 43 cases it appeared to have been transmitted by the male parent. It would also appear, according to these reporters, that all the animals attacked which had not reached three years of age, had acquired the disease by heredity, this number being twelve per cent. of those affected. In 1878, the number of cases reported by these veterinary surgeons as possibly due to heredity through the mother, was twenty-three.

Gerlach* thought that heredity had so much influence in this propagation of Tuberculosis, that it was sufficient to have a few tuberculous bulls in a herd to infect the whole, if in-and-in breeding was the rule. Johnet† is entirely in accord with Gerlach, and the numerous observations given by him prove that there can be no doubt as to the fact.

It is only rarely that we meet in veterinary literature with the history of cases of Tuberculosis, *which are maintained through a long series of successive generations in the animals of one and the same family* ; though, nevertheless, transmission from individual to individual in the same genealogical line is a fact which cannot be ignored by veterinary surgeons and agriculturists.

It will suffice at present to cite a fact reported by Fischer, of Wolfach, at the Veterinary Assembly held at Fribourg in 1882. In his district there was a stable, all the cattle in which were descended from a tuberculous cow ; these were two cows of the first generation, two cows of the second, and a heifer of the third ; and all these had to be killed in the course of the five last years, because of being affected with Tuberculosis.

The fact that Tuberculosis has not been generally observed in animals descended from tuberculous parents, except at an *advanced age*, and after they, themselves, have brought forth young, has given rise to two different opinions. According to the first of these, already alluded to, there are found among the animals

* "Fleischkost des Menschen," 1875, p. 52.

† "Deutsche Zeitschrift für Thiermedizin," 1883, p. 77.

already infected before birth, a certain number in which the primary focus of infection remains localised, or at any rate momentarily arrested in its development, at the same time that the morbid process is confined to organs the least important to the maintenance of life. In such cases it often happens that cattle are killed because of some quite different disease from Pulmonary Phthisis, or that they die from the latter malady at a later period ; and it is only at the autopsy that the lesions of Tuberculosis are discovered. If death has been due to this disease, it is because it has gradually invaded one or more important organs, or had suddenly disturbed or altogether suspended the function of one or several of these.

The second opinion, which is older and more universal than the other, is to the effect that *animals descended from tuberculous parents, inherit a special predisposition to the disease*. In human medicine an analogous, if not identical opinion has been entertained from the earliest times up to the present day. This is shown in the following remark by Morton : *—“ *Dispositio etiam hæreditaria sæpe sæpius Phthisin pulmonarem infert, cum omnibus sit satis notum, natos a Phthisicis Parentibus in eundem morbum esse proclives.*”

And Home † describes the characteristic signs of this predisposition in these terms :—“ *Huic morbo maxime obnoxia est actas inter vigesimum et trigesimum annum et forma, quæ gaudet humeris alatis, collo longo teneraque, statura procera et molli musculorum compage.*”

Is there a special predisposition to Tuberculosis among animals, and do they exhibit analogous pathognomonic signs to those here described ?

It is undeniable that the majority of the descendants of tuberculous animals have the neck long and slender, chest narrow, sides flat, shoulders thin and fleshless, and that they are “leggy” and their muscles small.‡ But it is also none the less

* “Opera Medica.” Editio ult. emendatior. Amstelodami, 1698. Lib. II., cap. i., p. 36.

† “Principia Medicinæ.” Third edition. Amsterdam, 1764. Section IX., p. 133.

‡ “There can scarcely exist a doubt as to its being hereditary ; this constitutional taint being remarked in different breeds, as associated with a

true that among tuberculous animals there are cows and oxen full of vigour, well formed, and attaining considerable weight, just as there are among them fat beasts whose exterior would not betray their phthisical condition.

These facts have their analogues in the history of human Tuberculosis; and it is, indeed, astonishing that in the presence of this evidence the existence of a predisposition to, as well as the hereditary transmission of, the malady should not have been accepted without discussion.

Among the adversaries of the old opinion relative to the predisposition to Tuberculosis, we may mention, as one of the most ardent, the illustrious Professor Cohnheim,* who maintains that man is no more predisposed to it than he is to Syphilis; that the hectic state is not the lot of the predisposed, but that of the individual already diseased; that the effect of the malady is confounded with an imaginary hypothetical cause; and that, finally, those only are tuberculous into whose bodies the tuberculous virus, received from without, has infiltrated and exercises its morbid action.

Cohnheim's opinion has, up to a certain point, its *raison d'être*, so far as mankind is concerned, the predisposition to Tuberculosis, inherent in the human species, being beyond doubt, and the belief in individual predisposition to this disease having become too deep-rooted and too generally spread. His assertion with regard to contagion is otherwise justifiable, and should change from indifference to circumspection those who believed themselves altogether exempt from all predisposition; while, on the other hand, it will allay the fears of those who suspected the existence of this predisposition in themselves.

According to the opinion of the illustrious professor, it ought to be admitted in every case that no person—not even those who are said to be predisposed—can become tuberculous without having been in contact with the special morbigenous agent of Tuberculosis.

particular physical conformation and temperament. Sex would also appear to be a predisposing feature in its production, cows being by far the most frequently affected. Animals of a lymphatic or nervo-lymphatic temperament, attenuated figure, long limbs and narrow chest, are apparently those most liable to be attacked, or to produce stock which will be phthisical.”—*Fleming*, “Veterinary Sanitary Science and Police,” vol. ii., p. 369.

* “Die Tuberculose vom Standpunkte der Infektionslehre.” Berlin, 1880.

Cohnheim's views are not without value to the veterinary surgeon, although, looking at the results of experiments accumulated up to the present time, they cannot be accepted to their full extent.

In appreciating the facts of which we are cognisant, even in leaving out of account the existence and the hereditary transmissibility of the general predisposition to this disease, which is incontestable in the case of cattle, pigs, and rabbits, the cause being found in the abundance of connective tissue in them; we are struck with the circumstance, that the majority of tuberculous animals furnished by a determinate population is composed of those which are related by ties of consanguinity. Compared with these, the number of victims the disease makes among cattle not related in this way is inconsiderable.

If it is desired to absolutely deny the infection of consanguineous animals during intra-uterine life, as well as that which we believe takes place through the medium of the udder, in order to explain the greater frequency of the malady among animals of the same family, the circumstance that these are much more frequently in contact with each other than with other animals should be invoked, *or their greater receptivity for the tubercular virus should be recognised.*

It cannot be denied that the number of victims to Tuberculosis increases with the improvement in, or specialization of, the breeds of the domesticated animals. The complaints so often heard among the breeders of pure stock, because of the considerable losses Scrofula and Tuberculosis occasion among these animals, support the opinion which attributes to hereditary transmission a notable *rôle* in the production of these maladies. It is more particularly the breeders of pure-bred pigs—races improved by the introduction of eastern breeds, which have such a marked predisposition to obesity—who complain of the losses caused by scrofulous affections. And does not Tuberculosis also make considerable ravages among certain of the most important strains of the Durham breed of cattle? Note the fact of a cow of this breed, four or five years old, being sold for £2,400 to go to America, where it died of this malady a few days after its arrival. And do not the breeding stock bought in Devonshire for the

imperial cow-sheds in Auvergne propagate the Tuberculosis in that fair domain?*

The great receptivity for morbigenous agents which is observed so frequently in high-bred animals, and which might be almost considered as one of their typical characteristics, is noted not only in the bovine and porcine species, but also in sheep and horses, as well as nearly always and everywhere among cultivated plants. This strong tendency among high-bred animals to contract disease, will ultimately fix a limit to those special varieties produced by in-and-in breeding.

With regard to Tuberculosis, we may specially consider, as causes inherent to the development of the predisposition, the ever-increasing mass of connective tissue in these improved and improving breeds of cattle and pigs, more and more specialized for the production of milk and fat. That extreme specialization—that exaggerated activity of the vegetative life in the absence of proportionate muscular exertion,—that fatty and gelatinoid degeneration which is met with in most of the tissues of these animals—does it not remind one of hot-house plants? This specialization, this kind of *hyperculture* once acquired, is, like every other character, *susceptible of being transmitted by way of heredity*.

Although it may not be essential to maintain in all its integrity the principle enunciated by Virchow, so far as infectious diseases, and especially Tuberculosis, are concerned, “that by hereditary transmission is not to be understood the transmission of the disease itself, but the predisposition to it, a predisposition which does not give place to the morbid disturbance except under the influence of certain external causes, or under the action of certain organic conditions brought about by the regular or irregular evolution of vital phenomena (periods of evolution),” yet we cannot reject either the idea of the existence, or that of the hereditary transmission of a predisposition.

* “A number of the South Devon breed of cattle were imported to the experimental dairy-farm of Saint-Angeau, in Auvergne ; . . . but all these, as well as their progeny (a cross with the *Auvergnates*), were gradually swept off by Phthisis. . . . So numerous were the cases of Tuberculosis occurring among these animals, that local observers believed the disease to be contagious.”—*Fleming*, “Veterinary Sanitary Science and Police,” vol. ii., p. 730.

From the preceding observations it follows—

Firstly—That heredity is not without influence on the propagation of Tuberculosis ;

Secondly—That this disease is transmitted by the male as well as by the female parent ;

Thirdly—That the transmission of the morbid principle to the ovum or foetus in process of development, is a cause of sterility in parents, and frequently occasions abortions or premature births ;

Fourthly—That a foetus infected with Tuberculosis only rarely attains complete maturity, and only infrequently is born in a state of normal viability ;

Fifthly—That, notwithstanding these facts, the possible birth (perhaps even a great number of births) of tuberculous descendants which may develop and multiply the same as those derived from perfectly healthy ancestors, and without any predisposition, cannot be denied ;

Sixthly—That tuberculous parents may transmit to their progeny a predisposition to Tuberculosis.

SECOND QUESTION.

What is the influence of contagion on the propagation of Tuberculosis ?

This question has been, if viewed aright, affirmatively solved in the preceding chapter, for we have furnished proof of the hereditary transmission of Tuberculosis ; this transmission being nothing more than the infection of the ovum or foetus through the medium of the parents, the reality of the infectant action of the disease has already been demonstrated, as well as its transmissibility from one individual to another in the special case of ascendant or descendant.

As there is, however, a difference between the transmission of a disease from the producing animal to the product, on the one hand, and from one individual to another simultaneously existing, on the other hand, we are compelled to draw a distinction between hereditary transmission and contagion, properly speaking ; and we cannot forbear from treating, in a special manner, of the con-

veyance of this disease through actual contact, that is *from one animal to another*, both existing at the same time, and enjoying life essentially independent of each other.

The contagiousness of Tuberculosis has been admitted from very remote times, as will appear from some quotations we are about to give ; but it should be remarked that the number of those who have questioned this contagiousness, or who have denied its existence, is greater than those who have professed themselves believers in its communicability.

Dr. Ruhling, who occupied himself with this disease in the general utility dissertations of Gottingen (*Gemeinnützige Abhandlungen*), published in 1774, says, "The disease is also transmitted to other healthy animals, the transmission taking place by the contact of those which stand beside each other in the stable and reciprocally lick each other, or inspire the air which has passed from the lungs of diseased animals. Frequenting the same pastures may equally suffice for this transmission."

The following is a very significant passage, extracted from the fourth part of Krunitz' Encyclopedia (Berlin, 1787, page 180):—"Besides, the heifers exhibit an ardent desire to copulate, and, which is remarkable, scarcely are they pregnant than they abort. In opening cattle which have been slaughtered, the first stomach, kidneys, and surface of the lungs are found covered with pustules similar to dried mulberries, or suppurating."

Fromage de Feugre* says, "The veterinary surgeons (*les hommes de l'art*) are agreed that this malady is not contagious, *although some cattle-owners think differently.*"

Huzard,† who, in the last ten years of the past century, had observed Tuberculosis among the milch cows in the neighbourhood of Paris, declared that many veterinary surgeons considered the disease to be *contagious*, and that certain physicians believed human Phthisis to be also communicable.

Spinola‡ mentions, among the causes of Tuberculosis, *contagion* as a possible cause.

* "Dictionnaire de Rozier," Tome V., page 336; article, "Phtisis."

† "Instructions Vétérinaire."

‡ "Handbuch der Speciellen Pathologie und Therapie für Thierärzte," Band II. Berlin, 1858.

Cruzel* categorically declares that this malady is contagious. "Much has been said as to the danger there is, so far as the health of animals is concerned, in keeping them in low, small, and badly-ventilated stables, but all has not been said in this respect with regard to Tubercular Phthisis. If there is in a low, narrow stable, containing several milch cows, only one affected with this disease, and if it has tubercles either in process of ulceration or suppuration, the air expired by it is remarkably foetid; and if this foetid air is respired immediately by another cow, it will convey the tubercular infection into its healthy lungs. . . . In this way the tubercular affection is communicated by the expired air; the facts in support of this assertion are numerous, and veterinary surgeons practising in the country may collect others almost daily."

"The following is a circumstance to which I would particularly call attention. Two working cows or oxen live in the same shed, and eat their food from the same rack or manger; lying in the same stable, they respire nose to nose. One is perfectly healthy, apparently; the other is in as good condition and as vigorous, but it coughs from time to time, and its breath is foetid. It is soon noticed that the animal which did not cough does not eat so heartily. . . . Phthisis pursues its ordinary course in the first which has been attacked, and its comrade, only emaciated at the commencement, is at length affected by the disease. If after this we do not desire to recognise in such a case the results of contagion, we may attribute them to cohabitation, to infection, or anything else we choose, but we cannot suppress the fact, or fail to see it very often reproduced in the circumstances I have mentioned." And in another place he adds, "I only ask, before adopting the opinion I have just given, that the veterinary surgeon or farmer bestows attention on what passes in every stable where a number of oxen or cows are collected, and that he observes without prejudice; for this opinion I have only acquired by observation."

Two years before the above was published, Lafosset† wrote: "Now-a-days medical men, in imitation of Morgagni, begin to

* "Traité Pratique des Maladies de l'Espèce Bovine," Paris, 1869, pp. 232, 244.

† "Pathologie Vétérinaire," vol. i., p. 646.

believe in the contagiousness of Phthisis. The facts published by Villemin appear favourable to this opinion, towards which our colleague, Dupont, of Bordeaux, has inclined for several years. This is a question which merits all the attention of observers and experimenters."

In Switzerland, Zangger* had, in 1859, declared that Tubercular Phthisis was a contagious malady in cattle.

But enough of citations; let us pass to facts.†

The transmission of Tuberculosis may take place in different ways. *The morbid principle may arrive in the organism by the respiratory or the digestive tract; the inspired air, the food, or the drink may be the medium; and the contagium may also be transplanted by means of the generative organs (through copulation), or by accidental means, as by accidental or intentional wounds.*

As animals live together, eat out of the same manger or from the same rack, we cannot, in the case of cohabitation, determine in a precise manner the part which the air and that which the forage plays in this infection. It is impossible to admit that, as a general rule, the animals whose respiratory organs are especially attacked have been infected by the respired air, or that those whose digestive organs are more particularly affected have been contaminated by food or water. In fact, the infective matter arriving in the pharynx with the food may well produce infection, and perhaps even much more readily, in the respiratory organs of the thoracic cavity than in the digestive organs of the abdomen.

It is not, on the other hand, so easy to separate the causes of transmission of the contagion due to the act of coition, from those which are the consequence of other causes of cohabitation, if it happens that the bull and cows used for reproduction occupy the same stable.

The facts relating to contamination which we are about to consider belong to the *conditions of cohabitation*. In bringing them together, we have paid no attention to the preponderating

* "Vergl. Schweiz. Archiv," Band XV., Heft 3, seite 265.

† The evidence in favour of the contagiousness of Tuberculosis in cattle is abundant and strong. I have given some facts in my paper on this disease, published in the *British and Foreign Medico-Chirurgical Review* for October, 1874. Others will be found in the VETERINARY JOURNAL.—G. F.

part which may have been played by the inspired air, the forage or the conditions relating to coition.

Stahl,* district veterinary surgeon of Waldkirch, duchy of Baden, has witnessed Tuberculosis develop in five bulls in one stable, and which were kept for the service of a commune. These bulls were not related in any way by parentage. Stahl attributes the outbreak of the disease to the purchase of a tuberculous bull which, by its presence, infected the others.

Renner† reports the following fact :—" A pregnant cow, newly purchased, was placed beside a tuberculous cow. The calf produced by the former was apparently healthy at birth, but five or six weeks afterwards it was attacked by shiverings, fever, fits of coughing, and great dyspnœa. The tuberculous cow was killed ; soon after the calf showed evident symptoms of Tuberculosis, and the same disease was manifested in two other cows which stood near the sick one, and which had not had any parental relationship with the others affected."

District veterinary surgeon Fischer, of Wolfach, at the eighteenth reunion of the Baden Veterinary Society at Fribourg, in 1882, gives the following facts :—" In a stable at Birkendorf Tuberculosis prevailed for two years, not only among the animals descended from a tuberculous cow, but also in three heifers placed beside the one first attacked, and which was derived from a perfectly healthy cow. The deaths were so frequent that it was feared that Contagious Pleuro-pneumonia was the cause, and sanitary police measures were already adopted as for that scourge. In a stable at Einbach the carcase of a cow was sold for food, which the inspector had declared was tuberculous. This animal had been bred from a healthy cow which, when killed, was twenty-one years of age. At the same time there were in the same stable two cows, derived from different mothers, which had the pulmonary cough characteristic of Tubercular Phthisis ; an ox, also, which had a cough at this time, was sold without a warranty."

Jamm,‡ veterinary surgeon of the arrondissement of Lœrrach, has published the following observations, which we think worthy

* *Lydtin*, "Mittheilungen über das Badische Veterinärwesen," 1874-80.

† "Wochenschrift für Thierheilkunde und Viehzucht," 1876.

‡ *Lydtin*, "Thierärztliche Mittheilungen," 1882, No. 7, p. 105.

of notice :—In the territory of Tannenkirch there is a farm called Kaltherberg, let for three years to a farmer named Gugelmaier. An average of ten to a dozen cows, some heifers, and a bull are kept ; these animals are partly of the Schwyz and partly of the Simmenthal breed, and are all lodged in the same stable. Four years ago this farmer bought at Fribourg, where he sells his milk, a grey cow, which soon began to cough and become emaciated ; consequently it was killed, and it was then found to be affected with Tuberculosis—pleural and pulmonary—to a very high degree. Since the purchase of this cow, Gugelmaier has lost ten other cattle from this disease, being obliged to kill some and sell others. The following is the succession of losses in this farm :—

1880.	June.	The first cow.	1882.	June.	The sixth cow.
„	Sept.	The second cow.	„	July.	The seventh cow.
„	Decem.	The third cow.	„	August.	The eighth cow.
1881.	Sept.	The fourth cow.	„	Sept.	The ninth cow.
1882.	March.	The fifth cow.	1883.	January.	The tenth cow.

In another animal—a fat heifer sold to a butcher, when it was slaughtered there were found a small number of tubercles.

In all these animals the disease commenced with a slight cough ; it did not last longer than three months. Pregnant cows generally began to cough towards the middle period of gestation ; after calving the disease progressed rapidly. It may be added, as an interesting fact, that the farmer lost, a year ago, a grown-up son, who died of Tuberculosis, and that the farmer's wife, for a long time suffering from Asthma, had been recently reported consumptive.

Veterinary Surgeon Ross,* of Achern, reports an analogous case in the following terms : “ In the month of April, 1878, the place of first tenant having become vacant at Obersasbach, W. was called upon to act in this capacity. In order to utilise some land placed at his disposal, in his function of schoolmaster, and more especially to provide his family with milk, he bought some cows. In about four years he was compelled to give up farming, because of the continual losses he sustained among his cows. The first he bought in 1878, but in 1879 he sold it to a butcher. When slaughtered it was found to be tuberculous

* Lydtin's “ Thierarztl. Mittheilungen.”

in the highest degree, so that its flesh could not be used as food. The second cow was bought on January 2nd, 1879, and lived for fifty-four days in the same stable with the first cow. It was sold to a butcher on December 10th, 1880, who returned the carcase to the farmer, as it was tuberculous to an extreme degree. The third cow was purchased on August 11th, 1879, and cohabited for four months with the preceding cow. It was soon killed because of Tuberculosis. A fourth cow, purchased on December 20th, 1880, remained with the third until April 30th, 1881. It was sold on November 10th, 1881, but the buyer returned it because of an intermittent cough.

“The first of these cows came from the stable of a neighbouring farmer, who latterly had, it was reported, often exchanged his cows for others, and was compelled to have a milch cow slaughtered, because of advanced Tuberculosis. The second cow had been reared by the vendor, and no diseased animals had been in his stables for ten years. The third cow was bought from a Jew dealer, and for several weeks after purchase did not cough. The fourth cow also came from an uncontaminated source. W.’s stables were excellent and well kept, and the cows were properly fed and cared for.”

Similar observations have been published by Viseur,* Grad,† Zundel,‡ Haushalter,§ and Lentz, who observed an instance of the disease becoming epizootic in the locality in which he practised, analogous to those instances reported by Huzard, Tessier, and D’Arboval in various parts of France, as well as by the two Belgian veterinary surgeons, Remy|| and Hugues.¶

With regard to the transmission of the disease by *forage and water*, several cases have already been alluded to, which nearly all occurred with young animals fed on milk from tuberculous cows.

* “Recueil de Méd. Vétérinaire,” 1873, p. 881.

† *Ibid.* 1874, p. 94.

‡ *Ibid.*, p. 93.

§ “Jahresberichte von Elsass Lothringen.”

|| “Transmission de la Tuberculose Bovine par Cohabitation,” 1881.

¶ “De la transmissibilité de l’Action de certains produits morbides,” etc., 1880. See also a very interesting and important communication in the VETERINARY JOURNAL, vol. i., p. 373, from Veterinary Surgeon Dewar, of Midmar, Aterdeenshire.—G. F.

According to Jessen,* it is an established fact that calves fed on the milk of tuberculous cows, even although the affection is yet latent in them, perish in from six months to a year.

Volkers relates facts which support the opinion of Jessen.

Lehnert relates in his annual report on Veterinary Medicine in Saxony for 1846, that he made the autopsy of two pigs derived from healthy parents, and sold while young as sucking-pigs. Their new owner, whose cowslieds were infected with Tuberculosis, fed them on unboiled milk from diseased cows. For four months they appeared to thrive well, but after that time they began to cough, became thin, and after six months he had to kill them. At the autopsy, exactly the same lesions were found as are noted in tuberculous cows.

Bromley,† of Lancaster, relates an analogous case. In opening the body of a calf that had died of Diarrhœa, Zippelius found tubercular ulcers in the intestines, disposed in circles, and tubercular lesions in the intestinal serous membranes. This calf was derived from a very tuberculous cow, which had suckled it, and which was subsequently killed because of the disease.

Gerlach considers the infection of calves by milk as being, after heredity, the most important cause of the transmission of the disease. In fact, to the ingestion of the virus with the food and drink ought to be attributed the development of the disease in many cases of sucking calves and pigs which, born in perfect health, die victims of Tuberculosis.

All the cases of Tuberculosis of the digestive organs, and particularly intestinal Tuberculosis, mentioned by Nicklas, Von Ow, and others, may probably be ascribed to infection by food and drink.

Infection by the generative organs has not been clearly demonstrated ; though it is probable that it may take place from the male to the female, and *vice-versâ*. Zippelius and Haarstick state they have observed instances in which this mode of transmission should be admitted. And a circumstance which appears to give reality to this mode of infection, is to be found in the fact that, although rarely, the sexual organs may alone be the seat of the lesions of

* "Wochenschrift für Thierheilkunde und Viehzucht," 1872, p. 346.

† Fleming: "Tuberculosis," p. 36 ; Walley: "The Four Bovine Scourges," p. 155.

this malady. Jessen* gives the case of a cow which had no other lesions than those found in the ovaries and Fallopian tubes ; and Schlotterer, of Karlsruhe, found Tuberculosis of the testicle in several bulls.

In certain cases, the transmission of the disease appears to have occurred through *accidental inoculation*. At Baden (the town in the Grand Duchy of that name), Contagious Pleuro-pneumonia broke out in a stable containing fourteen head of cattle. In one of these, slaughtered because of this disease, the lesions of Tuberculosis were recognised. At the request of the owner, ten cows apparently healthy were inoculated as a protective measure, the virus being obtained from the lungs of the slaughtered animal, these organs being perfectly free from Tuberculosis, and only showing the lesions of Pleuro-pneumonia in its first stage. Care was observed only to take the lymph that flowed spontaneously from the lungs after they had been freed from blood, and this lymph was filtered and kept for twenty-four hours in a cool place before being used. A microscopical examination of it (without recourse to staining) did not reveal the presence of any organised elements. The ten cows were inoculated ; the inoculation tumours formed in five of them, on the third, eighth, eleventh, twelfth, and thirteenth days, and gradually increased in volume, while they were hard, hot, well-defined, and painful to the touch, the animals themselves being feverish.

At the autopsy of these cows, which was made in from twenty-three days to two months after inoculation, none of the alterations characteristic of Pneumonia or tubercular Phthisis were found, except in one case, in which a few small yellow nodules were noted in the midst of a sclerous mass of interlobular connective tissue, about the size of an infant's fist, in the anterior lobe of the right lung. The inoculation tumours consisted of fibrous tissue, in the form of white, tendinous-looking, interlaced bands, almost as dense as cartilage, the meshes containing a greyish-white amorphous kind of matter. The latter contained, in its turn, nodules either spherical or a little oblong, red, grey, or yellow in colour, hard to the touch, and about the size of millet-seed.

The other five inoculated animals had no inoculation tumours,

* "Wochenschrift für Thierheilkunde und Viehzucht," 1872, p. 346.

but after death exhibited very marked tubercular lesions of long standing, probably anterior to the inoculation operation.

This observation was made by one of us (Lydtin), Medical Councillor Fuchs, of Karlsruhe, acting as assistant.* At the time when this observation was made (1868), we had already formulated the following questions :—

“*a.* Should measures be adopted to prevent the propagation of Tuberculosis among cattle, this being an incurable and fatal contagious malady ; and what should these measures be ?”

“*b.* Have the milk and flesh of tuberculous animals any influence on the health of mankind, if consumed as food, and are they noxious ? If the latter, is their action general or specific ?

“*c.* Is it necessary in the interests of human health to restrict, or eventually prohibit, the sale of these articles ?

“*d.* May the transmission of Tuberculosis be produced by vaccination, as well as by the lymph of Pleuro-pneumonia ?”

Unfortunately, these questions were not, at that time, so thoroughly discussed as they deserved, and it is only now that they are attracting attention.†

Toussaint reports that a pig which he had inoculated with the lymph of a tuberculous cow, was found after death to be affected with generalised Tuberculosis.

After having given the results of the clinical facts and observations known to us, we will pass to those afforded by experimental research.

In 1864, Villemin, with a view to studying the infective action of human Tuberculosis, had recourse to those experimental and methodical researches which had already been pursued by Majendie, Kortum, Hebréard, Salmade, Lepelletier, Gootlad, Deygallières, Laënnec, Erdt, Buhl, Klenke, and others.

The important experiments of Villemin produced a profound sensation in the profane, no less than in the scientific world.

* See “Recueil de Médecine Vétérinaire,” 1868, p. 770

† In the *British and Foreign Medico-Chirurgical Review* for October, 1874, I published an article on this malady, urging attention to its importance in a sanitary and economical point of view, and especially with regard to the public health. But it evidently did not excite the attention of the medical profession in this country, which has only quite recently become alive to its grave importance.—G. F.

Published and republished on every side, their results are so well known that it would be a mere abuse of the time and patience of the Congress to allude to them in detail. It will suffice to state that, as a consequence of his experiments, the illustrious experimentalist came to the conclusion that *Tuberculosis is an infectious and specific malady, capable of being transmitted from man to animals, and from one animal to another.*

Gerlach, in Germany, and Chauveau, in France, had, at nearly the same time as Villemin, made experiments to demonstrate the transmissibility of the malady, by inoculating animals with the matter obtained from cattle affected with tubercular Phthisis.

Similar experiments were also undertaken by the Veterinarians Colin, Soujou, and Court-Paul, Günther and Harms, Rivolta and Peroncito, Bagge, Bollinger, Köhne, Semmer, Biffi and Verga, Bouley, Peuch, Aufrecht, Toussaint, etc.

The different experiments to which they had recourse, were made on animals of different species and under different conditions ; so that there was no need to wait for corroborative results.

Some of the animals employed in these investigations exhibited a wonderful receptivity for the action of the inoculated matter ; others enjoyed an immunity inherent to their species or depending on their individual organisation ; while others may have been tuberculous before being submitted to experiment.

Rabbits, guinea-pigs, calves, pigs, goats, horses, dogs, cats, monkeys, and pigeons were experimented upon, and for the insertion of the supposed nosogenic principle various parts of the body were selected. Numerous inoculative procedures were invoked, and the matter selected for inoculation was used in different forms and after it had been submitted to varied preparation. It was inserted into the subcutaneous connective tissue, bronchi, the thoracic and abdominal cavities, as well as the blood-vessels ; it was introduced into the trachea after it had been reduced to powder, and it was passed directly into the stomach by means of the œsophageal sound.

Notwithstanding this great divergency in the essential condition of the experiments, the general result was such, that *the*

transmissibility of Tuberculosis, by various channels, could no longer be a matter for doubt.

The experiments which furnished negative results with regard to the contagiousness of this malady, could in no way affect the results of the experiments which yielded affirmative evidence, as in such investigations we cannot limit ourselves to enumerating facts, but must analyse and appreciate them. Is it not sufficient, when an experiment is made under irreproachable conditions, to establish a constant fact from a single positive result? Can negative results, counted by thousands, reverse an established fact? Evidently not.

In order to include at a glance the total of the experiments made, we shall present them as nearly as possible in the order in which we have given a *résumé* of the clinical facts.

Gunther and Harms placed five rabbits in a cage, which they suspended in front of the head of a tuberculous cow, in such a way that the rabbits were compelled to inspire the air expired by that animal. The autopsy of the rabbits did not reveal any alteration in their organs. The result was different when the animals were brought into contact with the expectorations from phthisical people. Tappeiner, in the experiments he made, and the results of which caused much sensation, found that the inhalation of matters expectorated by consumptive persons, even when in very small quantity, never failed to produce Pulmonary Tuberculosis in the dog, and, in certain circumstances, generalized Tuberculosis. The duration of the incubative period varied, in these cases, between nineteen and twenty-three days. According to this able experimentalist, the inhalation of scrofulous matter, or that derived from purulent expectorations from inflamed bronchi, will not produce Tuberculosis.

When these experiments were made, it was also sought to determine the action which the ingestion of such substances as the flesh and milk from tuberculous animals might produce on those who consumed them, and with this view experiments were undertaken nearly everywhere.

Johne,* in a very complete and learned work on the history of

* "Deutsche Zeitschrift für Thiermedizin und Vergleichende Pathologie," 1883, p. 32.

bovine Tuberculosis, gives the following *résumé* of the results of experiments made with the object of establishing this action :—

RESULTS.

ANIMALS EXPERIMENTED UPON—					Affirmative. Per cent.	Negative. Per cent.	Doubtful. Per cent.
1	Horse	...	...	...	0'0	100'0	0'0
5	Calves	...	...	...	100'0	0'0	0'0
35	Sheep	...	...	...	51'4	42'9	5'7
13	Goats	...	...	...	84'6	15'4	0'0
60	Pigs	...	...	...	65'0	18'3	16'6
17	Rabbits	...	...	...	31'2	66'5	2'3
20	Dogs	...	...	...	25'0	75'0	0'0
9	Cats	...	...	...	55'5	44'4	0'0
6	Guinea-pigs	...	...	...	83'3	16'6	0'0
2	Pigeons	...	...	...	0'0	100'0	0'0
322					43'5	51'1	5'0

Of the 322 alimentation experiments, 259 were made with uncooked food ; and of these the affirmative results were 47'7 per cent., the negative results 48'9 per cent., and the doubtful results 3'3 per cent. In 62 experiments aliment was employed which had been cooked for ten or fifteen minutes, and the following were the results : 35'5 per cent. affirmative, 64'5 per cent. negative, and 1 per cent. doubtful.

Classification of these experiments according to the alimentary substances employed, gives the following result :—

RESULTS.

					Affirmative. Per cent.	Negative. Per cent.	Doubtful. Per cent.
117	Animals fed with tuberculous matter from a heifer	...	...	...	61'5	34'2	4'3
46	fed with the raw flesh of tuberculous cows	...	...	...	13'1	86'9	0'0
91	fed with milk from tuberculous cows	...	...	...	30'7	59'3	1'0
1	fed with milk from tuberculous rabbits	...	...	...	100'0	0'0	0'0
25	fed with tuberculous matter from human beings	...	...	...	36'0	64'0	0'0
33	fed with tuberculous matter from a pig	...	...	...	53'0	47'0	0'0
2	fed with tuberculous matter from a sheep	...	...	...	100'0	0'0	0'0
2	fed with tuberculous matter from a rabbit	...	...	...	50'0	50'0	0'0
3	fed with tuberculous matter from monkeys	...	...	...	100'0	0'0	0'0
5	fed with tuberculous matter from birds	...	...	...	100'0	0'0	0'0

In reviewing these experiments and well-established clinical facts, Johne arrives at the following conclusions:—

1. The transmission of Tuberculosis may be effected from animal to animal and from man to animals, by the ingestion of tuberculous matters, but this mode of transmission is much more uncertain than that by inoculation ;

2. The matters which most certainly transmit Tuberculosis by gastro-intestinal ingestion, are those obtained from the lungs, the pleura, and lymphatic glands ; the milk of tuberculous animals, with regard to its more or less certain action as contagious matter, coming next to these. Infection takes place less readily with tuberculous matter obtained from mankind than with that from animals ;

3. Infection takes place less readily by the ingestion of flesh than by means of the substances mentioned in 2, and yet it was employed successfully in seventy-six of the cases shown in the above table ;

4. Calves, sheep, goats, and pigs present, as has been already mentioned, and as has been so well shown by Bollinger, the greatest receptivity for the tubercular contagium. With regard to the supposed immunity of the carnivora, it is not so definite as some authorities believe.

Among the experiments which specially merit our attention, we mention those made by Gerlach. Of 46 different animals submitted to experiment, and fed with *uncooked tuberculous substances*, 35 were infected ; of 35 animals fed with *uncooked flesh* from tuberculous cows, 8 contracted Tuberculosis ; and of 15 fed on *cooked* tuberculous matter, 10 became diseased.

Beside the experiments of Gerlach, we may cite those made by Bollinger.* The learned experimentalist employed the milk of tuberculous cows, which he gave to pigs, and the conclusions to which his experiments led him, in presence of the pathological preparations derived from them, was that *the prolonged consumption of the milk of tuberculous cows produced miliary Tuberculosis in the pig*.

The experimental inoculation of tuberculous matter into the *subcutaneous connective tissue, into the thoracic and abdominal*

* "Versammlung deutscher Naturforscher und Aerzte," 1879, in Baden.

cavities, and into the anterior chamber of the eye, has given a relatively greater number of facts in support of the transmissibility of the disease than the ingestion of this matter. Subcutaneous inoculations have, especially with rabbits, generally produced results analogous to those arising from the insertion of non-tuberculous matters. The authentication of this fact has been the cause of long and violent discussions, which did not terminate until Cohnheim, Salomonsen, Hänsell, Deutschmann, and Baumgarten had recourse to intra-ocular inoculations on white rabbits with pink-coloured iris. On this organ the tubercular evolution can be closely watched, and it is observed that, after an incubation of twenty to thirty days, there appear nodules on it, this change being followed by general miliary Tuberculosis.

Baumgarten* injected into the anterior chamber of the eyes of a certain number of rabbits, some drops of blood from a recently-killed animal which presented very marked lesions of Tuberculosis, developed after inoculation. By means of these injections he produced a typical ocular Tuberculosis, which rapidly led to general infection. Tubercles appeared after three or four weeks in the inferior segment of the iris, close to the point where the blood had lodged. The number of these tubercles gradually became more and more numerous in the eye, and finally there supervened the manifestations and lesions of generalised Tuberculosis, which killed the creature. This experimentalist repeated these experiments with the blood of healthy animals, but there was no consecutive morbid result. The result was also negative in several cases in which he substituted for the blood of healthy animals, that of creatures affected with Septikæmia or some other malady; in other cases the injection of such blood caused Ophthalmia of variable intensity, but never Tuberculosis.

Among recent experiments, we ought specially to mention those of Toussaint, Professor at the Toulouse Veterinary School. This observer has, by numerous experiments continued during several years, sought to demonstrate the contagiousness of Tuberculosis. For these investigations, which required thou-

* "Centralblatt für die Med. Wissenschaft." No. 15, p. 274.

sands of animals, he employed pigs, rabbits, and cats, as the disease is more surely and rapidly developed in them. The fluid expressed from the lungs of a tuberculous cow was that which he employed. He injected 1·5 cubic centimetres into a pig, and to two rabbits ten drops of this fluid, which was nearly quite transparent. He heated the fluid to a temperature of 55° to 58° Cent. for ten minutes in a water bath, and inoculated four pigs and four rabbits with it. All these animals became tuberculous, and the four which had been inoculated with the heated material perished even more rapidly than the others. Of the four rabbits, one succumbed thirty-five days after inoculation, and the others between the 164th and 170th day after the operation.

Two rabbits were inoculated with tubercles from the lungs of a pig which had been inoculated with the heated fluid, and killed three months afterwards. The rabbits were killed in about two months, and found tuberculous.

In another series of experiments, morsels of the flesh of a tuberculous pig were roasted in the flame of a gas-burner, and two rabbits were inoculated with the juice expressed from these. Two other rabbits were inoculated with juice from pieces of non-roasted flesh. The latter died 120 days after inoculation ; one of the former was killed on the fifty-sixth day, and was found to be tuberculous ; the other was alive when the report was published, but it was very emaciated.

In a third series of experiments, Toussaint employed nasal mucus, saliva, and the urine of tuberculous animals, for his inoculation experiments. Three rabbits were inoculated at the base of the ear with the transparent mucus that flowed from the nose of a phthisical cow. In about two weeks there appeared a tuberculous nodule at the seat of inoculation, and the *parotidean lymphatic glands* were tumefied. Seventy days after inoculation the rabbits were killed, and in their lungs were found tubercles, the majority of which were grey, and some were already undergoing caseation.

The inoculation of saliva from a tuberculous cow yielded the same result, only the lung tubercles were less developed. In injecting some drops of urine from a tuberculous pig, beneath the

skin of a rabbit's ear, rapid emaciation ensued, and four months after inoculation the rabbit died. The lesions of caseous Pneumonia were noted at the autopsy.

Reviewing the facts acquired with regard to Tuberculosis, Toussaint is of opinion that if cows lodged together in a building frequently become tuberculous, the cause should be sought, not in the food, but in the action of a morbid principle.

Chauveau had already observed that heifers which feed out of the same trough become tuberculous whenever a phthisical animal is found among them.

If among animals which live in the same stable, and eat and drink out of a common trough, there are those affected with the disease, the possibility of transmission of the contagium to all of them ought to be admitted.

There is another fact which merits attention. Toussaint vaccinated tuberculous cows by making seven punctures around the vulva, and implanting therein the contents of a vaccinal pustule, developed on a perfectly healthy heifer. Eight days after inoculation the vesicles appeared, and with the serosity from them four rabbits and a pig were inoculated. Two of the rabbits were killed in two months. Both were tuberculous. The other two rabbits were alive at the date of report, but in such a state of emaciation as to leave no doubt as to the existence of the malady.*

From the clinical observations already cited, as well as the numerous experiments which have been made, tending, as they do, to establish the infectious character of the malady under consideration, it evidently results that *Tubercular Phthisis is a contagious malady, equal, in infectiveness, to Glanders and Contagious Pleuro-pneumonia.*

It is not only contagious in the ordinary acceptation of the word, but it is also transmissible by the milk and flesh of affected animals, if these matters are introduced into the digestive canal. *Contagion plays, in the propagation of this disease, a more active part than heredity, which very often does not sufficiently explain its frequency.*

Another question which may be raised here, is as to whether

* "Compte Rendu de l'Académie," Tome 93, Nos. 5, 6, 7, 10, 15.

animal Tuberculosis is the same as human Tuberculosis, and if so, in what way they are related.

In attentively following the history of Tuberculosis in man, as we find it in the works of Waldenburg,* we are forced to recognise that physicians have been no more fortunate than veterinary surgeons in their attempts to clearly define the malady.

Until the eighteenth century, medical men had included under the designation of *Phthisis*, all the acute and chronic diseases of the trachea, bronchi, lungs, pleuræ, and lymphatic glands, whenever debility and emaciation accompanied these affections.

The existence of tubercles was more or less unknown to them. It was during that century—the epoch of the *renaissance* of anatomy—that physicians began to appreciate at their just value the pulmonary nodosities of Phthisis, which the majority of them had hitherto looked upon as *glandulæ*; but it was not until the second moiety of the century that Stark, in his description of the miliary tubercles of Phthisis, distinguished them from glands or *glandulæ*, and attributed them to a formation *sui generis*.

The English physician, Reid, from his researches arrived at the same conclusion.

At a later period—in the ten last years of the past century—Matthew Baillie not only ascertained that the groups of nodules or large nodosities were due to the confluence of miliary tubercles, but he also noted, in the most precise manner, the existence of tubercles in other organs than the lungs, and especially in the liver, spleen, kidneys, peritoneum, and cerebral envelopes. He also declared that the substance constituting the majority of the tubercles was a white, soft, cheesy material, which he qualified as scrofulous matter.

The works of Bayle and Laënnec, two French physicians, may be said to have served as a basis for the views now prevailing as to the nature of Tuberculosis. Bayle was the first to describe, under the designation of “miliary tubercles,” the small nodules which, by their confluence, give rise to the formation of pulmonary *noyaux*, and he was the first who insisted on their progressive development. He says:—“Tubercles may be present

* “Die Tuberculose, Lungenschwindsucht und Scrofulose.” Berlin, 1869.

in three different forms ; they are at first firm, then they soften in their centre, which is transformed into a purulent, grumulous matter ; finally, they are entirely destroyed by suppuration."

This physician also mentions the existence of nodules in the larynx, bronchi, tonsils, and mesenteric glands, and describes the ulceration of the mucous membranes, produced by the softening of the tubercles. He declares that the nodules do not indicate a local affection, but that they are due to a special diathesis—the tubercular.

As a pathognomonic sign of this affection, he considered the existence of the caseiform matter contained in the tubercles—matter which, according to him, consisted in a mass firm at first, then granulous, and latterly purulent ; this mass is always homogeneous, opaque, white, yellow, or greyish in tint, and may be present in the form of enkysted or non-enkysted tubercles.

Laënnec followed the path indicated by Bayle, but he simplified the subdivisions created by him ; he admitted only one kind of Phthisis—Tuberculosis—and declared that Scrofula was tuberculous glands ; and he included under the general designation of *Phthisis tuberculosa*, Scrofulosis, which he qualified as Tuberculosis of the lymphatic glands.

Microscopical investigation became gradually extended, and it was soon imagined that particular elements had been discovered in the tuberculous matter—the "tuberculous corpuscles." Cells of different forms were found, which some investigators considered were emigrated leucocytes of the blood, and others thought were epithelioïd cells. It was only at a later period that the presence of giant cells, containing numerous granules, were noted in the tubercles ; some observers even pretended to have observed a fine network containing cells in its meshes ; but it was soon perceived that neither the epithelioïd nor the giant cells were characteristic elements of tubercle.

The labours of Virchow gave a new aspect to the theory of Tuberculosis. The learned Berlin professor proved that all caseous matter was not necessarily tuberculous ; for, said he, if tubercles caseify, other neoplasms also undergo this transformation. According to him, we should only qualify as tubercles the caseous products derived from sub-miliary non-vascular nodules,

composed of spherical cells similar to the white corpuscles of the blood, not exceeding the size of a grain of millet, and at a late period undergoing caseification.

Virchow has recognised that, at the same time and in certain circumstances, tubercle is nothing else than an inflammatory product, and that it is an *infectious* affection ; and he establishes a distinction between Tuberculosis and Scrofulosis, Caseous Pneumonia, inflammatory exudates, and different neoplasms.

About the same period, Buhl also published his opinion that Tuberculosis was an infectious, and at the same time specific malady, and maintained that the tuberculous virus may be formed not only in the tubercles, but also in the caseous centres.

Finally, Villemin, by his important experiments, already referred to, demonstrated that Tuberculosis was undoubtedly an infectious malady, and that the virulence of the tuberculous matter is precisely the *criterium* of the tuberculous nature of a product.

From this time observers and experimenters have endeavoured to discover and to isolate the tuberculous virus from the morbid matter, and to study its exact nature.

Koch has solved the problem in demonstrating, by certain microscopical arrangements and special staining, the existence of certain minute elements, hitherto unobserved, in all the organs affected with Tuberculosis ; these elements are veritable *Bacteria*, and their presence is characteristic of Tuberculosis.

As important consequences follow this precious discovery, we may allude to it for a moment.

According to Koch, the *Bacteria* of tubercle manifest themselves in the form of threads of extreme tenuity, in length scarcely one-half the diameter of a red blood-corpuscle, and in breadth at most one-fifth of their length. They are non-motile, without proper motion, and form spores, which are developed during the life and in the body of the affected creature. They are never mixed with micrococci or other *Bacteria* in tuberculous centres protected from the air.

Therefore it is that we find them unmixed in recently-formed tubercles, though they are often accompanied by other proto-organisms in sputa or vomicae—in a word, where the air may come into contact with them.

In all cases in which the tuberculous affection is at its commencement and is making rapid progress, the *Bacteria* are in large numbers; but when the disease is developed slowly, these proto-organisms are only met with in small quantities in the parts altered by the disease, and they may even be entirely absent in the places where the malady remains stationary.

Koch does not wish it to be concluded, from the existence of *Bacilli* in the tuberculous neoplasms, that these parasites are the agents which cause the formation of the growths; for though he is led to believe that a close connection may exist between them, it is as yet merely a conjecture, which can only be established as a fact after further researches.

In order to prove that Tuberculosis is a purely parasitic malady, caused by the invasion of *Bacilli*, and especially by their growth and multiplication, it is necessary to isolate and cultivate them in a state of purity, free from every heterogeneous element, and until every morbid product from the tuberculous animal, and which might adhere to them, is got rid of. This Koch has done, and these isolated *Bacilli* he has transplanted in animals, and by this inoculation he has produced the morbid phenomena of Tuberculosis, such as are observed following experimental inoculation of the virus.

It was only after numerous attempts that Koch was enabled to obtain these pure cultivations; and with this object, he employed as cultivating fluid the serum of cow or sheeps' blood, sterilised, and kept at a temperature of 37° to 38° Cent. In this artificial soil, the tubercle *Bacilli* only developed at a temperature of 30° to 41° ; and the cultivations obtained in favourable conditions appeared to the naked eye in the form of small dry scales, which scarcely adhered to the gelatine or nutritive serum, which they never fluidified, as do the *Bacteria* of Anthrax. These scales or films only became visible towards the second week of cultivation—usually after the tenth day, and they grew so slowly that it was only about the third or fourth week that they attained the size of a poppy seed. These peculiarities, special to such cultivations, distinguish the *Bacilli* of Tuberculosis from all others yet known. Whether the *Bacilli* are obtained from human or animal tubercle, the result of

cultivation is always the same ; there exists no difference between the *Bacilli* of these two groups of tubercles.

By the inoculation of the *Bacilli* thus cultivated in the pure state, inoculation tubercles have been produced, with all the characters of ordinary tubercles, in experimental animals, and this even when the quantity of matter inoculated was very small. In the intentionally-produced neoplasms, the *Bacilli* were constantly present, and when removed from the growths they could again be cultivated and again be successfully inoculated.

By numerous researches properly controlled, Koch has proved that it was impossible to produce the typical alterations of miliary Tuberculosis by the inoculation of other matter than the *Bacilli* ; and he took great care, in his experiments, to adopt the necessary precautions to avoid confusing their results with spontaneous Tuberculosis, as well as to keep the experimental animals from exposure to any fortuitous cause of infection.

From his researches, Koch concluded that *the presence of Bacilli in the tuberculous masses constitutes not only a concomitant fact in the tubercular process, but that it is the cause ; and that we should see in the Bacilli the cause of Tuberculosis—a cause which had hitherto only been suspected, and which presents itself to us in the form of a vegetable parasite.*

Koch found exactly the same pathogenic parasites in the miliary nodosities from the lungs of eleven people affected with miliary Tuberculosis ; he has also always found them in the tubercles of the spleen, liver, kidneys, pia mater, and in the caseous bronchial glands ; as likewise in cases of Bronchitis and caseous Pneumonia (in six cases with formation of caverns, in the majority of which the *Bacilli* were very numerous), in an isolated cerebral tubercle the size of a nut, in tuberculous nodules developed around ulcers in the intestines in cases of intestinal Tuberculosis (two cases), in scrofulous glands recently removed (two or three cases), and in fungous Arthritis (two of four cases).

Koch has also found the same parasites in *ten animals affected with Tuberculosis, and which had calcareous nodosities in their lungs ; several times he has discovered them in nodules on the peritoneum, as well as in the bronchial and mesenteric glands.* He

has also found them in three cases in which the lungs did not present those characteristic nodosities with rounded surface, which are observed in ordinary Pulmonary Tuberculosis; in these cases, in the lungs there were spherical nodosities, with smooth-walled cavities, filled with a thick, pulpy, and caseous matter. This is a form which is not usually regarded as Tuberculosis.

The presence of *Bacilli* was also remarked in a lymphatic gland from the neck of a *pig*, in the organs of a *fowl* which had died of Tuberculosis, in the tuberculous nodules from three monkeys, nine *guinea-pigs*, and seven *rabbits*, which had died naturally. Besides these cases, which may be said to be spontaneous or accidental Tuberculosis, Koch examined thirty-two rabbits, seventy-two guinea-pigs, and five cats intentionally infected by tuberculous matter, and in all he found the *Bacilli* in the pulmonary tuberculous nodosities.

The facts established by Koch have been confirmed by the investigations of the principal authorities in mycology and pathology. These facts have not yet been seriously contested, and they demonstrate that, with regard to etiology, human Tuberculosis is identical with that of animals. The researches of the illustrious Berlin *savant* possess the great merit of having again drawn attention to the question of the consumption of the flesh and milk of phthisical animals, as well as to the care to be observed in vaccination.

In addition to the facts furnished by the discovery of Koch, which has settled the question as to the identity of human and animal Tuberculosis, reference should be made to the valuable investigations in this direction by Villemin and Klebs. These two able experimenters have demonstrated that *tuberculous matter derived from man will produce Pulmonary Phthisis in animals, and this inoculated Phthisis may be transmitted, by inoculation, to other animals.*

It can readily be understood that experiments to prove the transmission, *by inoculation*, of tubercular Phthisis from animals to man, with the object of producing Tuberculosis, must be excessively rare. With regard to inoculation from man to man, it is reported that Demet, Paraskeva, and Zallonis, inoculated with the sputa of a tuberculous patient, a person dying from pro-

gressive gangrene of the big toe, and who was apparently free from tubercles. He died thirty-eight days after inoculation, and on *post-mortem* examination recent tubercles were found in the two anterior lobes of the lungs.*

The following case of transmission of bovine Tuberculosis to man, related by Dr. Stang, of Amborach, has gone the round of the medical press. A boy, five years' old, apparently strong in constitution and descended from healthy parents, whose progenitors were exempt from hereditary disease, was attacked with Scrofula, and died in four weeks from Miliary Tuberculosis of the lungs and enormous hypertrophy of the mesenteric glands. When making the autopsy, it was accidentally ascertained that some time before the parents had to destroy a cow, which, according to the testimony of the veterinary surgeon, was affected with Pulmonary Phthisis. The animal had been a good milch cow, and for a long time the boy had received a quantity of the milk, immediately after it was drawn.†

* *Fleming* : "British and Foreign Medico-Chirurgical Review," 1874, p. 473. *Johne* : "Geschichte der Tuberkulose." 1883.

† It is very difficult to trace infection from diseased cows to mankind, as there are so many obstacles and objections to be overcome in accepting, as conclusive, evidence in favour of direct transmission, either through the flesh or milk. At most the evidence is only presumptive ; but it is by no means scant, and might be largely supplemented if inquiry were made.

For instance, in the discussion on Tuberculosis, at the meeting of the National Veterinary Association, held in London, in May, 1883, Mr. Hopkin said : " If we feed children on diseased meat, will it produce Tuberculosis now or ten years hence? I had an assistant who came to me from one of the islands on the coast of Scotland. The family from which he was derived was healthy and strong ; but when two of his sisters were young, the herd of cattle became affected with Tuberculosis. These girls were fed upon milk from these cattle. The two brothers, who were more fond of whisky than milk, are still hale and healthy—the sisters are lying in their grave, victims to Tuberculosis."

Human morbid anatomy also furnishes what may be deemed presumptive evidence, such as is given in Creighton's "Bovine Tuberculosis in Man." Judging from analogy, there can be little doubt that the disease is transmissible from animals to mankind, and the fact would be demonstrated very speedily if experiments could be resorted to. At the above meeting, at which I was president, in alluding to this point, I made the following remarks : " A great difficulty we meet with is that, while we can experiment upon animals to prove the transmissibility of the malady from one to the other, we cannot do so with regard to the human species. Gentlemen, it has struck me that we sometimes waste human life—that we throw away very good opportunities for experiment, by the manner in which we dispose of our criminals. I think no better use could be made of those condemned to death, than by experimenting in this direction. We know that if animals be fed for a certain time with tuberculous matter, serious changes will take place in their bodies, although

Another argument in favour of the identity or close relationship between *Tuberculosis of man and of animals*, is to be found in the analogies existing between these two diseases in regard to contagion and heredity.

From what has been observed in human embryos and the dead bodies of new-born infants, it would appear that Tuberculosis is hereditary.

Walshe* has demonstrated that this disease, in man, has the same favourable influence in the production of sterility and abortion as in cows.

Grisollet† and Dabreuil‡ have combated the old and popular belief in the favourable influence that pregnancy should have on the development of Pulmonary Tuberculosis. If that is admitted in human medicine, it is merely supporting a fact which has been for a long time accepted in veterinary medicine.

Since the time of Galen, a great number of physicians have maintained that Tuberculosis is contagious. Among these may be cited Morton,§ who states, with regard to the causes of this malady: "*Contagium etiam hunc morbum propagat. Hic enim effectus (uti frequenti experientia observari) lecti socios miasmate quodam sicuti febris maligna, inquinat.*"

Van Swieten|| says: "*Phthisis contagio afficit ab factore sputi.*"

Home mentions, among the causes of Phthisis, contagion as *causa procutarica*.

Maret has known many people succumb to Phthisis who were not at all disposed to the disease, but contracted it by wearing clothes previously worn by phthysical persons. Among others,

they may appear to be in perfect health. I do not know whether the hyper-sentimental people, the moralists of this country, would tolerate such a procedure; but I do think that criminals who so far offend against society as to take away human life, should thus be made to atone to that society whose moral principles they have violated." Feeding, or even inoculating, such criminals with tuberculous products, in order to discover whether, after execution, these products have induced the pathological alterations noted in animals so treated, would decisively, and for ever, solve a very serious problem in the sanitary condition of mankind.—G. F.

* The *Lancet*, July, 1850, p. 5.

† "Archives Generale," January, 1850, p. 41.

‡ "Gazette des Hopitaux," 1851, No. 118. "Bulletin de l'Academie de Médecine," Vol. XVII.

§ "Opera Medicin," Lib. II., p. 36. Edib. ult. Amstelodami.

|| "Commentaries," Lib. IV., p. 72.

he gives three instances which clearly show that sleeping with phthisical people may transmit the malady.* In consequence of this occurrence, he declared that it was dangerous to have close relations with phthisical persons, and he announced the fact publicly.

Other examples of transmission of the malady from man to man are given by Pothius, Schmidt, and Kruger,† and in *Hufeland's Journal*.‡ This is what we read on the subject: "The contagious power of Pulmonary Phthisis, which has been several times observed, has been lately confirmed in a very evident manner. A young farmer, in perfect health, received a present of shirts and clothes which had been worn by a person who died of Phthisis. He wore these articles, and in six months was dead from Phthisis." The writer adds: "How often may the unknown cause have been perhaps in the clothes or the beds used by phthisical people, and how difficult it is to discover the danger to which we are exposed in sleeping in a bed previously occupied by we know not whom (hotel or lodging-house bed)? Should it not be the duty of those who are entrusted with the sanitary service to see to the destruction of all the clothes, shirts, and beds which have been used by phthisical people in their last moments, as is prescribed by the Italian legislature? In all these cases, at least, these beds should only be used again after the flock (*duvet*) has been washed and exposed to the air for a year."

Fritzen§ gives some instances of contagion. He says: "The very judicious observation of a great number of physicians, that Pulmonary Phthisis is contagious, has been confirmed in my long experience. A domestic inherited from his master, who died of Phthisis, several suits of clothes, among which was a vest which he wore some time afterwards, without taking the precaution of washing it. Four weeks later the early symptoms of Phthisis manifested themselves, and he died in six months. A young woman in very good health, one of a family without any history of Phthisis, was married to a phthisical man, in whose family there had been several deaths from Tuberculosis. Some

* "Esprit des Journaux," Paris, 1779.

† "Ephemerides Naturæ Curiosorum, decuria," I., II., III.

‡ Vol. VII., chap. i., pp. 34, 35.

§ "Medic. Annalen," Vol. I., p. 231.

years after marriage, the woman became ill and died of Phthisis. The husband, who was fifty-two years of age, again married. His second wife, who was in perfect health at the time of marriage, subsequently died of Phthisis." After relating these facts, Fritzen adds that Phthisis is more especially transmitted from husband to wife, and *vice versâ*.* He recommends the prohibition of marriage with phthysical persons, and urges that the beds and clothes which have been used by tuberculous people be cleansed and disinfected.

Cullen, who did not think the affection was contagious, nevertheless did not deny the possibility of its transmission. This is the way in which he expresses himself: "Many physicians consider Phthisis as contagious. With regard to myself, I will not affirm that it is never transmitted by contagion. Nevertheless, among a great number of phthysical people whom I have had occasion to treat during my long career, I have scarcely met with an instance in which I could invoke contagion as a cause of the disease."† At a later period he published an instance to which a celebrated physician of Groningen was an ocular witness. "A young man predisposed to Phthisis, married a young Dutch woman of a sanguine temperament and good constitution. Some days after their marriage the woman lost her fresh colour and was affected with a bad cough; a month later she discharged bloody sputa. The doctor advised her not to sleep any longer in the same bed with her husband, but she would not take this advice; in six months she died of Phthisis. The nurse who waited upon her, and the domestic who, as a measure of prudence, was seldom in the bedroom, succumbed to the same disease." Cullen adds: "In all cases, Phthisis is more quickly and certainly propagated in hot countries than elsewhere; perhaps with us (in Edinburgh), the contagious principle does not become sufficiently potent to produce its injurious effect except in fine weather, when the hectic transpiration supervenes."‡

* I have known one instance in particular, in which a fine, strong, healthy man, whose wife suffered from Phthisis for some years, and died, became affected.—G. F.

† "Anfangsgrunden der praktischen Arzneiwissenschaft." Leipzig, 1870. Part II., § 553, p. 211.

‡ "Auszüge aus den best. Franz. Period." Schriften. Vol. III., p. 340.

At Rome, and in Italy generally, they are careful to conform to a police regulation which prescribes burning everything used by phthisical people.* It was for this reason that the greatest physicians of that country, among whom may be mentioned Morgani,† Valsalva, and Sarconi,‡ refused to make the *post-mortem* examination of phthisical persons. In that country it was even believed that in Tuberculosis, as with Leprosy among the Jews, the virulent matter was communicated through the walls of houses. Impressed with this idea, the Italians abstain, often for a whole year, from inhabiting a house in which a phthisical person has died.

In Portugal the beds and clothing of phthisical people are also destroyed.

In a work published in 1780, Dr. Wichmann, court physician at Hanover, gives, in a *résumé*, the views of many physicians and the laity as to the nature and contagious character of Phthisis a century ago. Alluding to the propagation of this affection, among other observations it is mentioned that at Zurich it is so prevalent, that one in every six cases of death is due to it. Yet the belief was that it is not so rapidly contagious, and does not so quickly alter or poison the air as the Plague, Variola, Scarlatina, or other maladies accompanied by a cutaneous eruption; though he asserts, at the same time, that the diseases which are characterised by the appearance of an exanthema or any other alteration of the surface of the skin, are not those which are capable of being transmitted by contagion. Many other affections, he adds, in which there is no eruption, may likewise be communicated by contagion, though the process is slower; contamination is less easily and less frequently effected through the medium of vehicles—that is, indirectly; transmission only occurs *when exposure to infection is frequent or long continued*.

Wichmann says, in addition, that he does not fear the objections of the orthodox, who would doubtless treat him as a heretic, because of his ideas as to the contagiousness of Phthisis.

* *Wichmann*: "Hannoverischen Magazin." 1780.

† "De Causa et Sedibus Morborum Epist." 22-3.

‡ "Del Contagio del Vajuole," 1770.

The anathemas of these persons he despised, as every observant physician might find at the bedside of his patients and in the midst of his *clientèle*, convincing proofs as to the reality of the fact he advances. He reminds those who deny the contagiousness of this malady,* that if scepticism is very useful in medicine, as well as in the other sciences, it may nevertheless lead to culpable indifference. He cites several instances of transmission of Tuberculosis between married people, and insists upon the necessity of preventing marriage with a phthisical person. As a preventive of Tuberculosis, he proposed the inspection of shops where were sold old beds or clothes which might have been used with phthisical persons, and insists on the urgency of not allowing children to cohabit with people affected with Tuberculosis.

If Wichmann's opinion has not received all the attention it deserved, neither at the time nor subsequently, the scientific experiments made eighty or a hundred years afterwards by Villemin and Koch have none the less proved its justness and reality.

The number of observations relative to the contagiousness of human Tuberculosis, especially between husband and wife, are daily accumulating to such an extent that the list of physicians who do not believe in the possibility of its transmission is progressively diminishing ; while clinicians, guided by the scientific discoveries already made, recognise more readily the ways in which the tubercle virus may be transmitted. If it be true that among these ways, that which conveys it from animals to man has not been appreciated as it ought to be, its existence has, nevertheless, been sufficiently suspected to lead to the notion that there was in the bodies of tuberculous animals some principle or factor which was noxious to mankind.

We will allude in more detail to these facts in the next chapter.

In summing up the data which we have dealt with in the preceding pages, we arrive at the conclusion that all the evidence points to the fact that the Tuberculosis of mankind and that of animals is one and the same disease, which, more than any other,

* "Die Schwindsucht, eine Polizeiangelegenheit." Hannöverischen Magazin, Chap. 51. 1780.

chooses its victims from among warm-blooded animals, irrespective of species, provided they live in agglomerations.

The following are the conclusions at which we have arrived :

1. Tuberculosis has been observed in all warm-blooded animals submitted to domesticity or deprived of their liberty.

2. Tuberculosis in animals and mankind presents analogous manifestations, in the living as in the dead creature.

3. The course and termination of the disease in mankind and animals is the same.

4. The masses of tubercle, and especially the sputa of the phthisical, produce Tuberculosis in animals, when these matters are introduced through the respiratory or digestive apparatus, or through a deep wound. Tuberculosis, inoculated from man to animals, may in its turn be transmitted from one animal to another, and always produces Tuberculosis.

5. Tuberculosis of man and of animals is transmitted by heredity.

6. The disease is contagious in man and animals.

7. There are clinical observations which prove the transmission of Tuberculosis from animals to man, by the consumption of the milk of phthisical animals.

8. Tuberculosis of animals and man is rare in cold climates, where it does not even appear to be developed. It is most frequent in southern countries ; the tracings of the geographical propagation of the disease in man and animals are nearly parallel.

9. It is evidently proved that a pathogenic microbe, having the same morphological and biological characters, exists in the tubercle of man and in that of animals. This organism, whether it be developed in man or animals, may induce Tuberculosis when, cultivated in a pure state, it is conveyed to the animal possessing the necessary receptivity.

When we consider that man derives a large part of his nourishment from the animals around him, we can scarcely doubt that an intimate causal correlation exists between him and them, with regard to this disease. If we carefully analyse the facts at our disposal, we shall find, concurrently with centres of Tuberculosis in animals, more or less numerous cases of Tuberculosis in man. We

shall note that, for the production of the disease in the human species, it is not absolutely necessary that there should be close vicinage between mankind and diseased animals ; the relations between both may be very effectively established through the indirect medium of the flesh and milk, sometimes consumed a long way from the locality in which they are produced.

The facts which we have adduced sufficiently prove the reality of this state of affairs.

As has been already said, it is more especially in dwellings containing animals exclusively destined to furnish milk or flesh, that Tuberculosis makes its ravages ; and these are precisely the dwellings which supply food to towns and industrial centres. The circumspect breeder is always on the alert with regard to the animals bred and reared by himself, and he is always anxious to dispose of them whenever they show any suspicious or morbid symptoms. These animals come in contact with others, and communicate to them the germs of the transmissible diseases with which they may be affected. In this way they introduce contagious diseases into the stables of dairymen and graziers, and ultimately, after a comparatively brief interval, the animals arrive at the butcher's establishment.

When the foci of animal Tuberculosis are met with in the great centres of human populations, we need not be surprised to find in these centres a large percentage of Phthisis in mankind.

So far as we have gone, we have only examined the question as to the transmission of Tuberculosis from animals to mankind. We ought to bestow a brief glance at the probability of the communication of the disease from man to animals.

Feeders of animals and dairykeepers in the neighbourhood of towns, daily use the refuse of kitchens for feeding purposes. This particular food, which may be sometimes mixed with the excreta of mankind, may convey the morbid matter of the disease under consideration, if the refuse and "swill" is obtained from houses in which there are phthisical people. The observations gathered by some Baden veterinary surgeons, relative to the frequency of intestinal Tuberculosis in cows kept in the vicinity of towns, as well as the fact alluded to by Veith, that the

droves of cattle living in a wild or semi-savage state in Hungary are exempt from Tuberculosis, are arguments in favour of this view. From what has been stated, it is established that the correlation between the Tuberculosis of man and animals is a real fact, *and that it is incumbent upon the sanitary police service to restrict, or even to suppress as much as possible, the operation of the causes of which this correlation is the consequence.*

We cannot terminate this chapter without adding a statistical table showing the comparative propagation of human Tuberculosis and the Tuberculosis of cattle. This table is calculated on the number of 100 persons and of as many cattle, and is drawn up from the reports from the different districts in the Grand Duchy of Baden in 1881. The indications are as exact as possible, as in each commune in Baden there is an official who inspects dead persons, and receives from the medical attendant information with regard to the cause of death, etc., this information being communicated every week to the district physician. In addition, each commune has a meat inspector who keeps a register in which is entered the condition of every animal slaughtered for food, and at the end of each quarter his observations are transmitted to the district veterinary surgeon.

Besides these, the communes have in their service knackers, who are entrusted with the destruction of carcasses, and are obliged to keep a register of their operations (information with regard to the number of animals and their diseases); this register is periodically inspected by the police, and is at the termination of the year sent to the veterinary surgeon of the district.

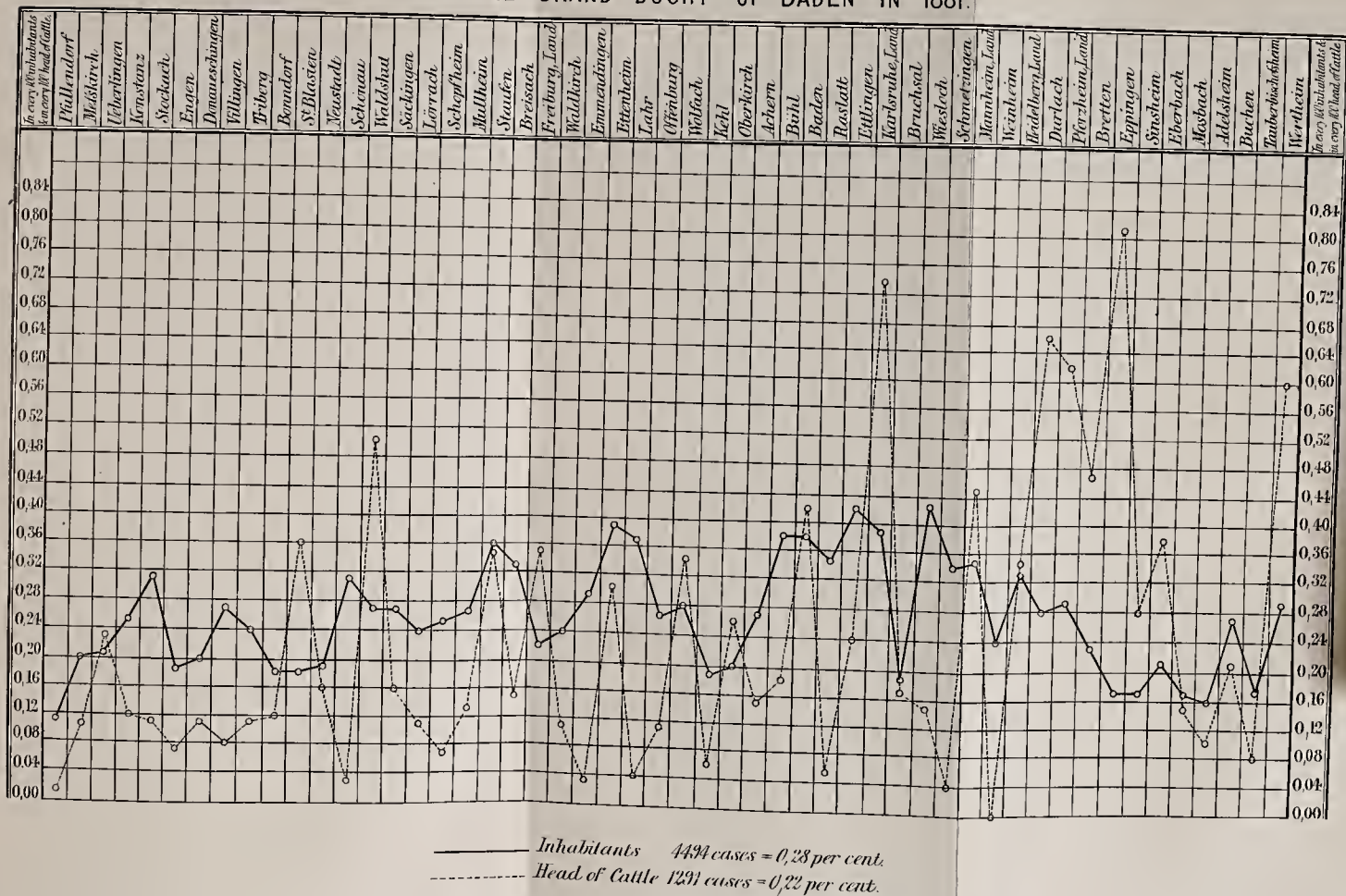
Veterinary surgeons are obliged to furnish, annually, to the Minister of the Interior a report on their professional work, in which they must mention the number of cases and the nature of the diseases they have known or been called upon to treat in the course of the year. All these reports and notices are sent to the government statistical bureau, and serve as the basis for a general report on the number of persons who have died of Tuberculosis, and of cattle which have succumbed to that malady, which have been destroyed because of it, or reported by the veterinary surgeons as being visited by them and found affected with it.

The annexed table, showing the deaths occurring in the human species from Tuberculosis, was published in the general report for the years 1880-81, issued by the Grand Ducal Minister of the Interior.

We have added the curve indicating the number of cases of Tuberculosis observed among cattle in each of the districts of the country. In following the two lines, in that which marks the mortality caused by Tuberculosis in the human species, and that which indicates the frequency of the same disease among cattle, there may be remarked an approximate parallelism in the two curves, if only we omit the arrondissements of Karlsruhe, Durlach, Phorzheim, Bretten, and Eppingen, where are established many butchers who supply meat of an inferior quality to the populous centres in their neighbourhood. The town of Wertheim, in the district of the same name, exports large quantities of sausages made from flesh of inferior quality—a circumstance which readily accounts for the high number of tuberculous animals noted there. It is to be remarked that the districts of Pfullendorf, Messkirch, Stockach, Engen, Villingen, Borndorf, Neustadt, Schönau, Adelsheim, Buchen, and Tauber-bischofsheim, are nearly exempt from Tuberculosis, and that very few deaths are caused by Tuberculosis in mankind. It may also be noted that breeding predominates in those districts, into which animals are rarely imported.

It must not be lost sight of, that the figures which include only one year are of little moment, and it is for this reason that we only give them outside that portion of the report which treats of the spread of Tuberculosis in general. The indications found therein seem, nevertheless, to confirm what has been said as to the causes of the propagation of the malady. It remains to be seen whether statistical researches will ultimately confirm or negative the results already obtained. These investigations are now being carried out, and it is to be hoped that they will also be undertaken in all other countries.

TABLE SHOWING THE DEATHS CAUSED BY TUBERCULOSIS AMONG THE PEOPLE,
AND ALSO AMONG CATTLE IN THE DIFFERENT ADMINISTRATIVE DISTRICTS
OF THE GRAND DUCHY OF BADEN IN 1881.



THIRD QUESTION.

What are the Preventive Measures which should be had recourse to, in order to avert the injurious effects which may result from the use of the flesh and milk of tuberculous cattle?

Tuberculosis being a disease, the history of which ascends to remote times, the spread of which is great, and the pernicious influence of which has certainly been recognised for many ages, the above question has very often been raised during a long period. The country whose civilisation dates from the earliest historic times, had legislative regulations with regard to food, and prohibited the use of flesh from diseased or healthy animals whenever it was considered injurious to the health of man.

In the Mosaic laws, amongst ancient legislation the best known, it is laid down concerning the disease with which we are now occupied, that the flesh of an animal, or a portion of an animal, which has been affected with general or partial Phthisis, must not be utilised as food; nevertheless, infractions of this law were not attended with corporeal punishment. If the malady had only reached the stage that the animal, though emaciated, might yet be supposed to be likely to recover, it was to be killed and its flesh allowed to be eaten.* In order to ensure the execution of the measure prescribed by the Jewish legislation, the slaughter of animals for food could only be performed by special persons, who were also entrusted with the inspection of the flesh, and decided, according to the principles laid down in the Talmud, as to the admission or refusal of this flesh for human consumption.

In the first instance, a particular mark was imprinted on the flesh,† and it only could be exposed for sale and eaten by the Jews.

These ordinances are still in force with the Israelites.

According to the Mischna, the oldest part of the Talmud, and which was revised toward the end of the second century of our era, the flesh of animals whose viscera showed perforations or morbid loss of substance, was not to be consumed as food.

* Leviticus, chapter xxii., verse 8; see also *Franck*, "Système d'une Police Médicale Complète." Vol. iii., Mannheim, 1783.

† Only Jewish butchers could apply this mark.

In those portions of the work which appeared at a later period, mention is made of vegetations (tubercular neoplasms) of the viscera, and particularly of the lungs ; and with regard to the last-named organs, whether the air blown into them did or did not penetrate these vegetations, also determined whether the flesh of the animal should or should not be allowed for food.

Hai Gaon, who died in 1038, states that the small vegetations (*Kandi*) are vesicular, and the larger ones (*Tinari*) are like stones (cretified phthisical nodosities).

The early Christians had, up to the third century, maintained without modification the laws of Moses with regard to food. At a later period, when the Jew-Christians, as they were called, had disappeared, these grand laws were not so scrupulously observed ; nevertheless, the bishops still sat in their respective dioceses every year as judges of morality, and conformably with the prescriptions of the Old Testament, they inquired whether the flesh or blood of hunted or torn animals had been consumed as food.

Schmidt mentions the morality jurisdiction assemblies, in his "History of the Germans." *

When panzoötic diseases (Cattle Plague and Anthrax) manifested themselves in the course of the ninth century, the Franks had published to them the laws of the Church, which interdicted the consumption of the flesh of diseased animals, and, among others, that of cattle and pigs affected with Leprosy—a term which, at that time, was synonymous with Tuberculosis and *Cysticercus Cellulosus*. The continuation of the Roman manners and customs which preceded the Christian civilisation, may have been partly the cause of the retention of the alimentary laws. At Rome, as is well known, the superintendence of the sale of food was entrusted to four market inspectors called *ædiles*, who, among others, had the power to order all bad or putrid flesh to be thrown into the Tiber.

In Italy, France, and Spain, as well as in South Germany and in the region of the Danube, where Roman civilisation and manners were introduced, we also find the institution of a more or less severe *surveillance* of the trade in meat. It is mentioned,

* Part i., p. 582.

for instance, in Krunitz' "Encyclopædia of the Economic Sciences," that in Spanish towns the cattle-dealers were always, up to the end of the last century, obliged to bring their animals to the slaughter-house at a certain hour, and after slaughter the carcasses of these were examined by a physician or surgeon detailed for this duty. If the flesh was found to be diseased, without any other form of procedure it was taken outside the city and buried. The inspection was gratuitous for the butcher and cattle-dealer.

At Paris, on January 30th, 1350, it was ordained that the butchers would only be permitted to sell healthy meat, and that they must conform to the law in this matter; and by a Parliamentary decree dated March 29th, 1551, butchers were rigorously prohibited, under pain of corporeal punishment, to sell, or attempt to sell, unhealthy or corrupt flesh; and they had to submit their animals to inspection by a functionary delegated with ample powers.

An ordinance of Wurtemberg, dated 1558, and the "Statuta Heinrich-Stadiensia," prescribe "that every day good flesh shall be sold by the butchers; that this flesh must not be coriaceous (*wolfbeissig*), nor from an animal suffering from Osteomalacia (*beinbrüchig*); that it be not infected with worms (*wurmig*) or maggots (*madig*), nor attacked with tubercular nor measles nodules (*finnig*); that it should be without fault or vice (*preishaftig*); that flesh not free from any of the lesions enumerated must not be mixed with healthy flesh; and that the latter must be kept separate from the former, so that it be not soiled thereby."

During and after the Thirty Years' War, bovine Tuberculosis was probably widely spread and attracted much attention; and at that time, by a fortuitous incident, it became still more interesting. This incident is thus described by Dr. Ammon: *—"In 1677, twelve students who had taken their repast in the convictorium of Leipzig, died. At the inquest it was proved that the hotel-keeper had given them, in addition to other food of a bad description, the flesh of emaciated and infected cows, whose viscera were covered with a great number of *vesicles*, of tubercular nodules (*Finnen*), and of purulent tumours. Externally, this flesh did not offer any abnormal appearance."

* "Dissertation Générale sur les Matières Alimentaires." Berlin, 1775, p. 275.

As a consequence of this fact, there arose different opinions as to the nature of tubercular Phthisis, and the danger of using the flesh of animals affected with this disease. Public feeling was greatly stirred by the unfortunate accident, and, exaggerating its proportions, it demanded severe protective measures.

In France, tubercular Phthisis was supposed to have some relationship to Leprosy, but in Germany it was imagined that it might be due to habits of sodomy, and that it was of a syphilitic nature. In both countries, rigorous measures were adopted against the sale of the flesh of animals affected with the disease. For example, by an Act of Parliament of Paris, dated May 28th, 1716, Antoine Dubou, overseer of the Field Slaughter-houses, was condemned to make an apology in his shirt, bare head, and naked knees, a rope round his neck, a lighted wax taper weighing two pounds in his hands, and a large placard on his back and another on his chest, on which was painted: "Overseer of the butchers, who has issued to the soldiers leprous flesh from animals killed because of the disease, and who has wickedly sold and distributed the flesh of unsound cattle." Being found guilty of fraud and other crimes, he was, in addition, condemned to nine years' banishment, and for ever deprived of the privileges of a butcher, as well as made to pay a fine of five thousand pounds, one-fifth of which went to the prosecutors. A similar punishment for the same offence, was awarded in the same locality on December 11th, 1716.*

According to Graumann,† a short time after the catastrophe at Leipzig, in 1680, severe measures were enacted in Germany for the prevention of the sale of the flesh of tuberculous cattle. In consequence of these evidently excessive measures, butchers dare not have anything to do with the carcasses of cattle which showed the least trace of the disease. Such carcasses, and even the pole-axe which had been used to slaughter the cattle, were handed over to the public executioner.

Towards the middle of the last century, these draconic measures, which weighed so heavily on the breeder and feeder, began to be protested against. It was also reported that the

* *Tscheulin* : "Thierärztliche Polizei," 1821, p. 56.

† "Franzosenkrankheit," 1784.

executioners (*Scharfrichter*) did not bury diseased carcasses, but consumed them in their own families, or sold them to third persons, without any injury or inconvenience ; and it was pointed out that there was not so much severity in the butchers' share of the confiscation, inasmuch as he could recover his pole-axe by paying a fine of a thaler. Gradually the subject attracted the attention of a certain number of medical men, and these began to combat, with some degree of success, the idea that the malady was syphilitic in its nature. Among these persons we may mention Zink (1764), Ruhling (1774), Heim (1782), and the special physician of the Grand-Duchy of Mecklenburg, Graumann, who has written the best treatise on Tuberculosis and its non-identity with Syphilis. Unfortunately these *savants*, in proving that this disease was different from Syphilis, *also taught it was not contagious, and that, consequently, the flesh of animals affected with it might be consumed with impunity.*

This inexact and hasty conclusion, still more unfortunately, had additional serious consequences, for certain physicians, animated by an excess of zeal, publicly advertised the good quality of such flesh. A tuberculous ox having been slaughtered at Brukenau, Zwierlein, a doctor of medicine and philosophy, took twenty-five pounds of its flesh, and consumed it himself, in order to demonstrate that such meat was destitute of the injurious qualities attributed to it. What is more, this doctor prepared a quantity of broth made from tuberculous nodules, and drank it in the market-place before a large number of people.

These ideas gaining ground, the various Governments were obliged to intervene by ordinances, and rescinded the previous laws passed with regard to this flesh. So it was that the Prussian Government published on June 27th, 1785, an official notice in the following terms :—"That in order to terminate the unjustifiable practice of handing over the flesh of tuberculous animals to the public executioner, there is need—

" 1. To enlighten the public on this question.

" 2. To make known the true state of things with regard to the action of the flesh of tuberculous animals, which a mere prejudice has generally given rise to the idea that it is injurious to health ; and

"3. To afford instruction as to the course to be henceforth pursued with regard to this flesh."

In this proclamation it is also stated that the flesh and milk of animals affected with Tuberculosis should not be considered suspected, except in cases where the lesions of this malady are present, and then the diseased portions were to be removed ; the remainder of the carcass being left for the disposal of seller and buyer, as it might, without the slightest prejudice, so far as health was concerned, be utilized as food.

A circular issued by the Imperial Government of Lower Austria on June 11th, 1788, contained a less categorical decision. In this document, it is admitted that the tuberculous growths are found in the healthiest animals as well as in diseased, and that the flesh of the latter is in itself healthy. If, nevertheless, it is added, such growths are found in the abdominal cavity and in the other regions of the body, and if the animals had been cachectic and nymphomaniac, their flesh should be considered as injurious to the health of mankind, and its use should be strongly discouraged.*

In Southern Germany, Austria, and Switzerland, the flesh of tuberculous animals was always more or less rejected. In these countries it was certainly admitted that the flesh of cattle in good condition, even though some tuberculous nodules might be found on the pleura or peritoneum, was not unfit for food, though care was taken to remove the nodules from the serous membranes before disposing of the carcass for alimentary purposes. If the nodosities were numerous, or seated in the lungs or liver, these organs were rejected for food, and the flesh was sold as of inferior quality, if it had a good appearance. The carcasses of animals which were wasted and much diseased were not allowed to be used as food.

A police regulation, issued in the Duchy of Baden in 1772, relative to the inspection of flesh, is framed on these lines. Another ordinance of veterinary sanitary police which appeared in 1840, in the Canton of Appenzell-Ausserhoden,† shows that at that date a similar practice, still existing, was in vogue in

* "Contributions Choiesies à l'Art Vétérinaire." Part iv., p. 249. Leipzig, 1788.

† *Ibid.*

Switzerland. In this document, three degrees of tubercular Phthisis are distinguished, with regard to the consumption of the flesh of diseased cattle. The *first degree* is characterised by only a few tubercular growths, and the healthiness of the flesh and viscera. In the *second*, the growths may be everywhere in the organs, but the flesh is still in a good state; but in the *third degree*, the neoplasms are so numerous in the pleural and peritoneal cavities, as well as in the viscera, that the flesh is evidently altered, being changed in colour, and the connective tissue is infiltrated with serum. That of the first and second degree is allowed to be sold for food, but the purchaser has the right to demand from the seller a reduction of twenty per cent. Flesh of the third degree is not admissible as food, and the carcase, with the exception of the skin and fat, must be buried. The fat may be used for other purposes than human food. Any damage incurred falls upon the seller.

Bavaria, Wurtemberg, and the Grand Duchies of Baden and Hesse have, in their latest regulations with regard to meat inspection, maintained these indications in principle, thus respecting the ancient and popular custom. For instance, in the regulations for the Grand Duchy of Baden, published in November, 1878, it is laid down that flesh is to be rejected which comes under the three following categories:—

1. That which has a bad smell or is putrefying.
2. That of animals which have been overdriven or exhausted.
3. That of animals which were affected with Anthrax, Rabies, Glanders, Farcy, *tubercular Phthisis* (pulmonary or serous) *to an advanced degree*, Trichinosis, Measles, or any disease marked by the decomposition of the nutritive fluids.

It is likewise mentioned in the instructions relative to the inspection of meat, that *if the morbid alterations have only invaded certain parts of the animal, these are to be excluded from consumption as food, and the remainder may not be exposed for sale in the ordinary butcher's stall, but must be sold as inferior meat, in establishments ad hoc.* It is also forbidden to expose for sale, or to sell, flesh from animals showing marked and extensive lesions of *tubercular Phthisis*.

While in the South German States meat inspection has been

carried out for centuries in all the districts, by means of experts—empirics or skilled persons, such inspection being still in force; in the centre and north of the German Empire, the arrangements for the inspection of slaughter-houses and carcasses, which were introduced towards the end of the last and commencement of the present century, when Cattle Plague was so prevalent, have disappeared.

In recent times, nevertheless, a considerable number of German towns have instituted abattoirs, in which all animals intended for food are slaughtered, and the authorities take the precaution to have the meat inspected. Among these towns may be mentioned Berlin, Hanover, Dusseldorf, Elberfeld, Erfurt, Cassel, Munich, Stuttgart, etc.* In several localities in North Germany, because of outbreaks of Trichinosis, inspection of certain meat is obligatory; and in Prussia, since March 18th, 1838, there is a law with regard to public abattoirs, in which *all* the animals intended for the food of people in the different localities must be slaughtered.

The penal law of the German Empire, and the arrangements relative to the trades and professions in force in that country, interdicts the sale of improper flesh; and on May 14th, 1879, there was promulgated a law of the empire, dealing with the traffic in food, and prohibiting the sale for slaughter of animals affected with certain maladies, or the flesh of these. The sanitary board of that empire has already drawn up an ordinance in view of these interdictions, so that it is to be expected that in the near future there will be uniform measures throughout the whole country, and which shall be applicable to slaughter of animals affected with Tuberculosis, or their flesh. In the meantime, the towns and localities of any importance are endeavouring to concentrate slaughtering in public places open to inspection.

In France, the inspection of meat has attracted the attention of the authorities from the earliest times. Besides the Act already alluded to, may be mentioned the police code of 1767 in force in that country, in which are regulations relative to the

* In the United Kingdom, only a few towns have abattoirs, as Edinburgh, Glasgow, Liverpool, Manchester; but I fear meat inspection in them is not one of the objects for which they were instituted.—G. F.

sale of animals which have died of disease, as well as the laws of August 14th, 1790, and of July 22nd, 1791.

Dalloz, in the following quotation, shows how the prohibition of the sale of flesh of tuberculous animals is provided for in these enactments.

"The same may be said of the flesh (prohibition of sale) of an animal killed when diseased. Certain maladies act, in fact, on the living animal as the laws of decomposition and fermentation do on the dead one; for here occur one of those spontaneous transformations which alter the flesh and prevent its being used as food. The prohibitions in the old regulations were not less formal on this point . . . otherwise, before the law of 1851, they appeared to adopt the same solution, for an order of the Cour de Cassation, of 13th August, 1847, qualifies as spoiled and corrupt food (*comestible gâté et corrompu*) 'glandulous' flesh (*viandes glanduleuses*) offered for sale."

Gelle * also states that the flesh of animals affected with tubercular Phthisis in an advanced stage should be confiscated, and to judge by the statements of experts, his opinion is shared by many veterinary practitioners and experts in France and Belgium—Bouley, Verheyen, Dupont, Hugues, etc.†

France was the first to regulate the public abattoirs, and to organise a regular and convenient inspection of animal food. Napoleon I., by a decree of February 9th, 1810, suppressed private slaughter-houses in large and medium-sized towns, and ordered the establishment of public abattoirs. Article 3 of the Ordinance of April 15th, 1836, completed this primary measure, as by it, it was decided that the opening of a public abattoir in a given locality entailed the closure of every private slaughter-house therein.

Analogous arrangements were adopted in Belgium; there, at the same time, were instituted public abattoirs, and a well-organised inspection of meat, not only in the large towns, but also in some of the small ones.

* "Traité de Pathologie Bovine." Tome ii., p. 517.

† See also the "Bulletin de la Société Centrale de Médecine Vétérinaire," 1883, p. 14. Many British veterinary surgeons are of the same opinion. See the "Proceedings of the National Veterinary Congress," published in the VETERINARY JOURNAL for August (p. 126) and September (p. 209), 1883.—G. F.

In several of the large English cities there are similar establishments.

The scientific investigations with regard to the danger attending the consumption of flesh from diseased animals have never been suspended, although the effects of the alimentary products from tuberculous animals had not been specially inquired into. Since the end of the last century, investigations have been instituted as to the action of putrid meat and that which has been altered by disease. These investigations, which were in reality a continuation of those previously begun by Heim and Graumann, were continued during the first half of the present century. By them it was demonstrated that the ingestion of putrid flesh, as well as that derived from diseased animals, is not so dangerous as was supposed; and this demonstration caused several of the most distinguished *savants* to maintain that such food is not injurious, if it is previously properly cooked. Payen, for instance, says: "Positive facts demonstrate that raw flesh has no deleterious properties as food, even when it is in the first stages of fermentation, or when it is derived from animals affected with contagious or inoculable diseases (Anthrax), or those which are endemic; its dangerous properties disappear by boiling it. Thus, while condemning butchers, sausage-makers, etc., who sell the flesh of animals affected with disease, or putrid meat, the authorities should be assured that the accidental sale of such meat does not compromise the public health."

Renault, then director of the Alfort Veterinary School, at the conclusion of a long series of experimental researches commenced in 1828, asserted: "1. That there is no sanitary reason for prohibiting the feeding of pigs and poultry with the *débris* of knackeries, whatever this may be; 2. That there is no danger to mankind in eating the boiled milk or cooked flesh of animals—cows, oxen, pigs, sheep, or fowls—affected with contagious diseases, whatever may be the repugnance which these products may naturally inspire."

Other experimentalists have contested the legitimacy of these conclusions, which were evidently too far-fetched; and the melancholy occurrences at Kloten, Switzerland, and elsewhere, have demonstrated in the clearest manner how well-founded these doubts were.

Thus it was that Verheyen, who nevertheless had known instances in which the flesh of diseased animals had been consumed with impunity, was of opinion that there was nothing to prove the innocuousness of such flesh when cooked. Recognising the, happily, infrequent cases in which the consumption of such flesh was followed, not only with serious accidents, but with death, the Belgian Academy of Medicine came to the following conclusions:—

“1. The flesh of healthy horses may be allowed to be sold as food without any inconvenience to the public health ;

“2. Horses and other animals slaughtered for food, affected with inflammatory diseases in their early stage, may be so utilised, provided that the precaution is taken to have them bled to death ;

“3. Animals attacked with Dropsy (*Cachexie aqueuse*), and advanced *Phthisis*, Small-pox, Measles (*Cysticercus cellulosus*), Rabies, and Glanders or Farcy, either acute or chronic, or Typhoid or Anthrax fevers, as well as poisoned animals, should be excluded from consumption.”*

The latter opinion is now entertained by the great majority of *savants* and veterinary practitioners in central Europe.

Unfortunately, we do not know, or only imperfectly, the state of affairs existing in other countries, so that we cannot give a full notice with regard to the matter. The information which we have furnished will, nevertheless, suffice to show how much, on every side and during all time, attempts have been made to arrive at a competent *surveillance* with regard to the sale of flesh, and the articles of food manufactured from it, and particularly with a view to the preservation of mankind from the injurious influence of that derived from tuberculous cattle ; this circumspection has had a tendency to increase in recent days.

The Congress can only, then, confirm the decisions of similar assemblies which have preceded it, and in doing so respond to a general desire of governments, as well as local administrations,

* “Dictionnaire des Alterations et Falsifications des Substances,” etc. Vol. ii., p. 513. Paris, 1855.

by accepting the following decision, which we respectfully submit to the members of this fourth international reunion.

It is of the greatest urgency that, in all the districts in which animals are sacrificed for human food, these animals should, before and after slaughter, be examined by a competent person, if possible a veterinary surgeon, whose duty it should be to seize all flesh which is injurious to the health of mankind.

With regard to the special sanitary police measures in force against the use of flesh from tuberculous animals, these exist in a more or less precise and categorical form in the South German States, as well as in Austria, Hungary, Belgium, Spain, France, Switzerland, and Italy. Such flesh is usually divided into three categories, according to the degree of alteration presented by the carcase ; so that there is first-class or good flesh, second-class or inferior flesh, and flesh which is not allowed for consumption. The first is absolutely wholesome, and may be sold without restriction of any kind ; the second can only be sold as food on certain conditions ; and the last is not permitted to be sold, but is confiscated.

This classification, it must be admitted, is based only on a tradition which cannot be unconditionally accepted, and on the idea that lean meat full of morbid products should not be allowed for consumption, as it is not nutritive and causes disgust.

The reality of the danger resulting from the employment of alimentary matters derived from tuberculous cattle, has only had a scientific basis since the institution of Villemain's researches into the infectious nature of Tuberculosis ; but it was Gerlach, director of the Berlin Veterinary School, who was the first to undertake really special investigations in this direction. He instituted experiments, those experiments on the action of suspected matters when ingested, to which allusion has been already made ; and he ascertained that not only the ingestion of tubercular materials, but also that of *the flesh of tuberculous animals*, will often determine alterations of a tubercular and caseous character in the animals experimented upon. He usually obtained this result if the matters or flesh were given in a raw state ; rarely if they had been previously cooked.

The experiments made by this *savant* satisfied him that the morbigenous principle of tubercle exists everywhere in the tubercle itself; that this principle may, at some point of the organism, be taken up by the lymphatic vessels, and by them be carried to a lymphatic gland, which in its turn becomes diseased. From this gland the nosogenous principle is gradually propagated to other parts of the body, as the pleura, for example; very frequently it is enkysted.

All these phenomena require for their completion, says Gerlach, a somewhat long interval, so that the flesh of tuberculous animals is not noxious at the commencement of the disease. During this period of the affection, the body of the diseased creature certainly contains the morbigenous virus of Tuberculosis, but only in certain limited situations which, in the majority of cases, can be recognised as diseased, this principle being fixed, it may be said, outside the flesh usually consumed as food, and in such small quantity that it can scarcely do any damage.

Gerlach was decidedly of opinion that flesh commenced to be hurtful when it can be demonstrated, by its persistent traces, *that Tuberculosis, starting from a limited tuberculous centre, has become more or less generalised throughout the organism.* As a proof of this propagation, he considers:—

“1. The existence of tuberculous lesions in the lymphatic glands in the vicinity of the organs which are the seat of tubercular neoplasies, and which may, in such cases, be looked upon as the point of origin or spread of the morbid infection;

“2. The presence of caseous centres; especially in the lungs, these centres indicating that they are already undergoing disintegration. The greater the number of these centres, the greater is the infective power and noxiousness of the flesh;

“3. The secondary extension of the tubercles;

“4. Evident emaciation.”

According to this learned professor, it is sufficient if one of these characteristics is present to justify the rejection of such flesh for human food.*

The principles enunciated by Gerlach have been very differently estimated by competent authorities. *Some pretend that the*

* “Die Feischkost des Menschen.”

flesh of tuberculous animals is not fit for food in every case ; they adopt more or less the opinion of Gerlach, and demand that an investigation should be made as to whether the flesh is injurious, whatever the development of the disease may be, or if it is only so when it has reached a certain stage, and what that stage really is. Others completely adopt the views of Gerlach ; and others, again, maintain that the temperature of boiling water destroys the morbigenous principle of Tuberculosis, so that the flesh of animals affected with this disease may be consumed with safety, provided it has been previously boiled (Lothar Meyer, Decroix) ; and they accept the views previously enunciated by Payen, Renault, etc., while others are of opinion that indecision in such a question is inadmissible, and that a conclusion should be arrived at as to whether or not the flesh of such animals should be eaten (Semmer). Certain authorities, as Zundel and Johne, assert that, with regard to the utilization of this flesh, the opinion prevailing in South Germany, for instance (see p. 112), should be maintained ; and some others consider the question as not yet solved, and ask for further investigations.

The Imperial German Veterinary Council seems to entertain the latter opinion, for at a meeting held in Berlin in 1875, the following conclusions were voted :—

“ 1. The facts and observations collected up to date, with regard to bovine Tubercular Phthisis and caseous Pneumonia, and more particularly with respect to their transmissibility to mankind, merit attention, but they are not conclusive, and especially do not suffice to convince us as to the danger of Tuberculosis being transmitted to the human species through the medium of the flesh and milk of animals affected with this disease, and to justify prohibition of the sale of these products ;

“ 2. The permanent bureau is authorised to apply to the Chancellory of the Empire for the means necessary to solve the question if, and to what point, the consumption of the flesh and milk of tuberculous cattle is injurious to human health.”

The direction of the Berlin Veterinary School, consulted in 1878, in a legal dispute on this subject, in its arbitative capacity, gives an even more reserved opinion than the German Veterinary Council. The following are the terms in which it gives its views :—“ It is not yet proved that the flesh of a cow affected with

generalised Tuberculosis, but otherwise very fat and well nourished, may not be utilised as food for man; the scientific experimental researches undertaken with this object have not yet demonstrated that the opinion expressed by different experimentalists, that the flesh of a tuberculous cow, especially when the organism is largely involved, contains an injurious specific principle and ought to be excluded from human consumption, is erroneous," etc.

Johne,* who of all others has best treated the question from a practical point of view, thinks that Gerlach went too far in considering the flesh as hurtful when the disease had invaded the lymphatic glands in proximity to the tuberculous centre. According to Johne, to produce a really injurious effect, *generalised Tuberculosis* must be present—that is to say, the nosogenous principle of tubercle is no longer confined to the peripheral lymphatic circulation, where it was more or less localised, but has reached the thoracic duct and the vascular system, and is diffused all over the body. Whatever may be the species of animal intended for food, if it is affected with Tuberculosis, *and yet the carcase does not present the characters of tuberculous metastasis*—that is, generalised Tuberculosis—infection of the flesh cannot be admitted, and there is no necessity for condemning it, so long as the tuberculous organs, as well as the vessels and lymphatic glands along the course of the circulation from the affected organs to the thoracic duct, are not allowed to be consumed as food. In order to be more certain of safety, the neighbouring vessels and connective tissue surrounding them should also be removed.

With regard to the flesh, Johne remarks that no matter what the condition of the animal may have been, it should be considered as free from danger; at most it is of inferior quality, and should not be rejected if there is no other cause.

It is not the same if the presence of the above alterations renders it probable that the blood is infected. In such a case the entire carcase, no matter how high the condition of the animal may have been, should be seized, as it is unfit for food.

* "Deutsche Zeitschrift für Thiermedizin und Vergleichende Pathologie," 1883. Heft 1, 2.

Gerlach and Johne are agreed in maintaining that emaciation is not a necessary manifestation of general infection, as animals affected with pulmonary, hepatic, or intestinal Tuberculosis sometimes waste rapidly without the disease becoming generalised ; but cattle suffering from well-marked pleural or peritoneal Tuberculosis may preserve their condition for years, and even fatten—though this fact does not prove that they may not at any moment succumb to general infection.

Zundel is of opinion that, so far as injury or danger from the use of such flesh is concerned, up to the present time only theoretical considerations, based on imperfect experiments which are opposed to the facts derived from close observation, have been invoked. Such opinions cannot retard those measures which are devised with a view to protect the public health ; if they were accepted, a tenth part of the meat actually consumed without inconvenience would be withdrawn from consumption. The discovery of Koch, he adds, shows that the parasite of Tuberculosis is only met with in the pathological productions characteristic of this malady, and are not diffused, like certain other of the infectious diseases, throughout the whole of the juices of the body, nor yet in the blood ; and it is for these reasons that the *Bacilli* are not found in the flesh. As a result, says this learned Principal Veterinary Surgeon of Alsace Lorraine, it follows that the practice hitherto pursued should be in no way modified, and that, as in the past, only the flesh of wasted and wholly infected animals should be interdicted as food ; the utilisation of that which is derived from cattle less diseased may be allowed, if it be recommended to consume it only after it has been well cooked.

If, as is shown by what has been adduced, very diverse opinions have been given on this subject, yet no one has ventured to assert that nothing should be done to prevent the evil consequences likely to attend the use of the flesh of tuberculous animals ; on the contrary, the universal opinion is *that sanitary police measures should be adopted to avert the injurious influence of such flesh.*

The desire of those who, for some years, have considered this question as not capable of solution, and who, for this reason,

have urged the necessity there is for new experiments, has been gratified.

These experiments have been made and repeated, and when they have been conducted with proper precautions they have yielded positive results. The *Bacillus* of Tuberculosis has been recognised, isolated, cultivated, and transmitted by inoculation; whatever may have been the soil from which it has been transferred (man, animals, gelatine, etc.), it has always caused the development of true Tuberculosis in the animal into which it was transplanted, and it could always be transmitted from one inoculated animal to another. The experimental evidence is therefore complete, and the problem may be looked upon as solved. The response is affirmative with regard to the noxious influence of the flesh of tuberculous cattle, and the majority of those who were previously doubtful are now convinced.

If we exclude the opinion of those who believe that the question is not yet sufficiently elucidated, the number of whom should now be very limited, we are finally brought face to face with two very different opinions as to the preventive measures which should be adopted:—

a. According to some, *all the preventive measures may be reduced to the simple advice to cook the flesh well before eating it;*

b. According to others, *the flesh of tuberculous animals should be confiscated, either in every case, or in certain circumstances.*

If the two solutions are examined with regard to their efficacy and their practical application, we are brought to the admission that the first is certainly that which will find the greatest number of adherents among the farmers and butchers, who will support it heartily. “They who eat the flesh or drink the milk,” say they, “have only to take care that these are properly cooked; in this condition they are not hurtful, as the temperature of boiling water kills the tubercle parasite, and thus removes all danger of infection.”

Cooking is, it must be confessed, a precious means of disinfection—a means which it would be difficult to replace with advantage, when it is desired to ensure the healthfulness of food. While in the North of Germany, where much flesh is consumed in a raw state, it is not possible, even with the aid of the micro-

scope, to prevent outbreaks of Trichinosis ; in those countries where meat is nearly always well boiled or roasted that disease is either very rare or unknown, although it may be that nothing more is attempted as a preventive than a facultative inspection and the advice not to eat raw flesh.

The recommendation to consume only cooked flesh and boiled milk is certainly commendable, in order to prevent Tuberculosis in those countries where the recommendation does not clash with deep-rooted manners and customs. Where people are in the habit of consuming raw or imperfectly cooked meat, such a recommendation would not be followed ; and as a proof of this we may note that the extensive outbreaks of Trichinosis in North and Central Germany, have not yet caused the neighbours of the unfortunates who succumbed to the malady to abandon the use of raw pork.

When the recommendation to properly cook meat is not favourably accepted by all ranks in society, it cannot be considered a practicable measure for a State which does not wish to resign itself to the *laissez faire* and the *laissez aller* principle, with all its consequences.

That which has just been said with regard to the recommendation, applies with equal force to the prohibition. An inconvenience which is added to the latter, besides non-observance, is that the profane, confiding in the application of the recommendation or prohibition, may believe that *all* cooked flesh is innocuous, which is not exactly correct.

The temperature of boiling water kills the *Bacillus* of tubercle, but this temperature is not attained throughout the whole mass of a piece of meat prepared for consumption ; the portions insufficiently heated may therefore preserve their infective property ; and on the other hand, the germs and spores of the *Bacillus* may resist this temperature and retain their germinative power. (See the experiments of Gerlach and Toussaint.)

If, as a general rule, flesh-food is not perfectly cooked, is not even exposed to the temperature which alters the colouring matter of the blood, ordinary cooking can neither be recommended nor ordered as an efficient preventive, so far as flesh is concerned.

Besides, the question may be looked at from the other side. When we have to consider, in such a case, the preventive measures necessary, it is not alone the interests of the butchers and breeders, that is, the providers of flesh, which should be taken into account ; the consumer should also have a voice in the matter, and his manner of looking at it should even have a preponderating value. He who pays in money for the entire value of the meat he purchases, has a right to expect a corresponding quality in what he buys. In those countries where he is protected by the law, which prohibits the sale of putrid flesh, or that from diseased beasts, the consumer would protest energetically if he were required to purchase that of phthisical or marasmic animals as good and genuine food. Even those who maintain that in no case should we confiscate the flesh of tuberculous animals, and that it is sufficient to boil such flesh, would not have it offered for sale to the generality of the public (Payen, Renault, Decroix, Lothar Meyer). It is for this reason that Lothar Meyer wished that such flesh should be sold in those places where poor people are supplied with food, as the common cook-shops (*Volks-Küchen*), etc. It is true that this proposition should not be looked upon in the light that the poor are better able to digest such food than the rich, but rather that it is only brought forward on the ground that in hospitals and cook-shops the cooking of animal food is better attended to, and that in accepting such a proposition we are preserving for the poorer section of the population innocuous food, which, under ordinary conditions, would usually be lost.

Although Meyer's proposition might, from a philanthropic point of view, be perfectly justified, it would nevertheless appear, if carried into practice, as if it were intended to make poor people eat flesh, perhaps diseased, which was not good enough for the wealthier classes. The moral effect of such a measure might have more serious consequences than the material and pecuniary losses entailed by the confiscation of animals affected with Tuberculosis.

These are all the remarks we have to offer on the recommendation or obligation to *boil* or *roast* the flesh from tuberculous cattle—a measure which, it must be admitted, is useful and

acceptable, but in no way sufficient ; and it is these considerations which compel us to notice the other measures which have been proposed.

The second essential proposition which has been put forward, is relative to the *confiscation of the flesh of tuberculous cattle in every instance, or at any rate in certain determinate cases.*

Confiscation in every case would certainly be the most efficacious measure for the preservation of human health. From the veterinary surgeon's point of view, it is unobjectionable, as the diagnosis of the malady is usually very easy, and in difficult and doubtful cases a microscopical analysis would suffice in order to arrive at a decision.

But on the other hand, putting the necessary measures into practice offers numerous difficulties. The old proverb that "The judges of Nuremberg do not hang a man until they have laid hands upon him" is perfectly applicable here, as it is first requisite to know where the tuberculous flesh is to be found before it can be confiscated. The discovery of such flesh must form part of a most difficult task, as to attempt it an invasion of the domain of the butcher and breeder must be made, and this would provoke a conflict all the more serious as the measure would prove effective ; and this is not a hypothesis, but a statement founded on everyday experience.

Partial confiscation, that is, the confiscation of certain kinds of flesh, is, as has been already said, carried out in certain countries, where it is even enforced as a legal measure. Simple prohibition, even when supported by the threatened infliction of a penalty in case of infraction, will not cause butchers and farmers to make a report which may lead to the confiscation of their diseased animal. The dread of the butcher lest the reputation of his establishment should be tarnished through the intervention of the police, induces him to conceal the malady, and all the more readily, as declaring its presence would cause him notable material loss. For these reasons, animals intended for slaughter, abattoirs, and the sale of flesh, have all been placed under the control and surveillance of the police (except in England), for it is only the constant imminence of such control with regard to meat exposed for sale, that gives efficacious

support to the announced penalty ; and it is the same imminence of control which causes the butcher to conform to the law when he knows he cannot elude it.

The obligation to have all animals intended for food slaughtered in abattoirs and under the surveillance of competent persons ; the prohibition of transporting meat, and fresh preparations of meat, instead of killing the animals in other districts ; the severe surveillance under which this transport may ultimately be allowed to take place, and an incessant inspection of the butchers' shops—all these are measures of real efficiency against the sale of the flesh of tuberculous cattle.

Notwithstanding all the prohibitions, animals affected with this disease are nevertheless clandestinely slaughtered ; as the farmers, the dishonest cattle-dealers, and the low-class butchers, are always ready to make the most out of a diseased beast.

In the Grand Duchy of Baden, where a system of meat inspection has been for a long time organised, it is generally admitted by those who are competent to form an opinion, that about 20 per cent. of tuberculous cattle escape inspection.

The sanitary police measures in force (on the Continent) would act in a less satisfactory manner in preventing the sale of such flesh, if they were not to a certain extent seconded in their action by the fact that, from an early period up to the present day, this disease has been classed among those which caused any animal to be warrantable and returnable. The butcher who has, unknowingly, purchased a phthisical beast, incurs a loss which the seller must make good. If the latter does not consent to do so, then the butcher may institute an action against him, and thus make known the malady from which the animal is suffering.

There are, however, cases in which the rights of warranty are lost *a priori*, and in which, consequently, public proclamation of the disease does not take place. Many farmers, and particularly those who know the condition of their animals, or who have already been laid in damages in consequence of the existence of Tuberculosis among their cattle, sell *without warranty*, and usually to greater advantage than those cattle-owners who have confidence in the healthy condition of their animals. The butcher who buys without a warranty has no interest in de-

declaring the existence of the malady which he may detect in the animals he has killed, or is about to kill ; he takes good care to kill and dress in a public abattoir the cattle he suspects are affected, and dresses the carcase, removing the diseased parts, and sending the remainder into the market for food. This is one of the least dangerous courses which may be followed in such cases.

Much more serious consequences may result if this flesh is sold to be manufactured into sausages. The manufacturers of these desire a good profit on the meat they buy, and they find this most readily with the owners of cattle who sell without giving a warranty ; it is more especially these persons who use up for food the carcasses of phthisical cattle which have been in an advanced stage of the affection. In preparing these sausages, all kinds of meat, healthy or diseased, are chopped up together, and a mass is obtained which is at least disgusting to the eye, and which, being often consumed in a raw, or half-raw state, may compromise the health, and even the life of those who eat it.

The laws of warranty* come therefore to the aid of the sanitary police measures, so far as tuberculous cattle are concerned ; but they are as insufficient, as the best-organised system of meat inspection can be, to prevent the noxious action of their flesh in the most serious cases of this disease.

And to-day, as it was during the past century, when all the flesh of a tuberculous cow was given to the knacker, those persons whose interests suffer through these sanitary measures attack the laws or regulations concerning meat inspection, and it would appear that they will not renounce their procedure until these are absolutely abandoned, as has happened before.

The following instance may be cited as evidence of what is now stated. When, inspired by the writings of Gerlach, certain meat inspectors in the Grand Duchy of Baden, among whom may be mentioned Veterinary Surgeon Fuchs, of Mannheim, attempted to apply a little more rigorously and conscientiously the measures prescribed in the regulations for the inspection of tuberculous cattle, the butchers and owners of stock acted in

* * We have nothing like the *lois sur la redhibition* of the French, the *Gewährsmangel* or *Gehwärsleistung* of the Germans.—G. F.

such a manner that serious consequences were apprehended. The latter declared that they would no longer sell to the butchers of Mannheim, or at least that they would not be bound by warranty; and the butchers, on their side, pretended that before submitting to all the risks attending the soundness of meat, they must insist on raising the price. Other butchers announced that they would no longer slaughter in the town abattoirs, but would bring into the town all the meat their customers required. In proceeding thus, the butchers, like cattle-owners and cattle-dealers, threw all the extra charges on the consumer, who, without taking into account the fact that he was all the better protected in his health by receiving better meat, saw only in the application of these severer sanitary measures an attack on his pocket. And the butchers, on the other hand, endeavoured to escape from the more severe control, thus further diminishing the guarantee due to the consumer. Such a state of things could not go on, and the more severe measures to which recourse was had for the moment, had to give place to the less rigorous ones previously in force.

If, in order to prevent clandestine slaughter, resort be had to domiciliary visits, rewards for information, etc., considerable police expenses will be incurred, and this without any certainty of achieving the desired result. The persons who keep hotels and boarding-houses of an inferior class, would still remain the customers of those who slaughtered phthisical cattle without informing the authorities. The more the unenlightened public continue to ignore the danger they incur in consuming such flesh, or to doubt the reality of this danger, the more they will consider the application of these preventive measures as a new and useless vexation emanating from the police, and be inclined to resent the more active intervention of the authorities.

If the confiscation of tuberculous cattle has already met with great difficulties when carried into practice, these difficulties are much increased when attempts are made to determine in what cases flesh may be admitted for consumption, and in what cases it should be prohibited; and *technical difficulties* must also be added to the list.

When it is decided to seize *all* the flesh of phthisical cattle, it

suffices to establish the existence of the lesions of Tuberculosis, in order to decide if the flesh of a tuberculous beast *may* or *may not* be allowed for food. In the latter case, it is necessary not only to endeavour to determine minutely the extent and degree of development of the tubercular alterations, but we ought also to know how and where to select the infected portions of the carcase from those which are to be utilised as aliment.

The knowledge necessary to meet all these requirements is only to be found combined in the veterinary surgeon who practises these inspections.

Some authors, who, like Gerlach, are of opinion that there may be admitted as food certain portions of the flesh of tuberculous cattle and other portions refused, recognise the difficulties to be encountered when one is required in such a matter to decide in a given case; then the most experienced and skilled practitioner will often find himself embarrassed.

In treating of these difficulties, Gerlach, among others, says :—
 “When we have to deal with things, and have arrived at that point that we must differentiate between them, we may always arrive at opposite conclusions. If it is already very difficult to trace a limit between health and disease, it is still more difficult to establish exactly the moment when the virulent principle of a morbid process, primarily localised, becomes generalised in the organism. If on such a limit or frontier conflicting interests meet, we need not be astonished that divergent opinions may arise. The meat-inspector will perhaps demand in a given case the absolute rejection of the flesh of a diseased animal, and the breeder or dealer—in a word, the owner of the animal—will claim that the flesh may be perfectly fit for consumption; the latter will only yield to confiscation when there is nothing to reject—that is, when the animal is so diseased that its carcase is worth nothing.”

In cases of dispute as to the use of the flesh of a phthisical cow, it is necessary, according to Gerlach, to have recourse to the arbitrament of a veterinary surgeon who, in such a case, may judge with competence and impartiality. In giving judgment, he should preserve the flesh which there is reason to save, *without endangering the health of man, the consumer.* “When

his scientific knowledge does not enable him to separate the noxious from the innocuous, and doubt persists, the expert should admit the existence of danger and, consequently, in such cases decide to *reject* the flesh, maintaining his opinion so long as the innocuousness of the meat is not established."

Johne also maintains that, in order to ensure a good inspection of meat, public abattoirs are necessary, as well as a corps of inspectors composed of veterinary surgeons, well posted up in the scientific work of their profession, and competent in the practical work of inspection.

According to Zundel, meat inspection, in so far as Tuberculosis is concerned, should, in country as well as in town, be a general measure, applied with intelligence, and based on well-established facts.*

Although in southern Germany it has for a long time been the custom to class the flesh of tuberculous cattle in several categories, notwithstanding a strong desire to do so, it has not been possible to replace an empirical by a rational inspection. So long as private interests are, in the general interest, likely to be injured by way of judgment, so long will there be a disposition to sacrifice right to sentiments of indulgence ; judgment will be generally in favour of him who is injured, if for the injury he is not responsible.

In order to properly differentiate the flesh of tuberculous cattle which may be allowed for food, from that which cannot be admitted as aliment, it is necessary that in every district there should be a conscientious and independent inspector, or a person specially selected for this duty, whose exclusive function would be the inspection of meat in that district. This would, of course, cause considerable expense, which would have to be defrayed by the Government, the districts, the consumers, or the butchers.

In addition to the expense, there is another difficulty connected with this preventive meat-inspection, and this is a consequence of the sometimes very narrow limit existing between the flesh which is consumable and that which is not. The

* "Nature Parasitaire de la Tuberculose." Strasbourg, 1882, p. 14.

more or less hypothetical indications met with in medical literature, do not furnish a sufficiently positive basis for the determination of this limit. The possibility of transmitting Tuberculosis through the medium of the milk furnished by tuberculous cows, would lead to the supposition that *apparently localised Tuberculosis does not always consist in alteration in certain organs only.*

The morbigenous principle appears, according to this information, to have already invaded the secretive organs at a period when no macroscopical lesion was present to indicate the existence of any alteration in them. Therefore it would appear from this fact, that where the means of investigation with which science has provided us are at fault, we cannot expect the practitioner to establish a precise and clear distinction in the special cases to which we refer, and in all of them, with irrefutable arguments to support him, to define the limit between that which may and that which may not be consumed.

The difficulties to be encountered when we are called upon to give an opinion with regard to the flesh of a tuberculous animal are undeniable, and are such as to be scarcely evaded ; it therefore follows that the confiscation of meat always offers, in this respect, *desiderata* which can scarcely, or at most only incompletely, be obtained.

From all that has been stated, it may be concluded that, in itself, the confiscation of phthisical cattle, no more than the recommendation or order to eat only cooked flesh, will preserve us in a complete manner from the danger of infection with which we are threatened by tuberculous meat. To attain the desired end, this confiscation should be reinforced by auxiliary arrangements. In a word, mitigated measures are not efficacious, and severe measures are not strictly observed.

The circumstances which may preserve mankind from the harmful action of the *milk*, are, happily, more easy to realise than those which should completely guarantee us from the danger likely to be incurred from consuming the flesh of tuberculous animals. It is, nevertheless, true that we do not know the special character which would allow us to distinguish, either by the

naked eye, or by the aid of chemical or ordinary physical analysis, healthy from infected milk, while, on the other hand, obligatory search for the tubercle *Bacillus* in all milk would be an excessive and impracticable measure. Besides, the compulsory sanitary control of all milch cattle by veterinary surgeons would be not only very difficult to ensure, but it would be also very vexatious and costly, and, after all, would not afford absolute security.

To prohibit the sale of the milk of cows presenting symptoms of tubercular Phthisis would be without result, the milk not being subjected to sufficient control, so far as its origin is concerned.

The recommendation not to use the milk until it has been boiled has more likelihood of being observed, and is more certain of success than that relative to cooking the flesh. Milk is a fluid which heats uniformly, so that we may admit that in boiled milk every specific principle of Tuberculosis, as well as the virus, is destroyed. In addition, the milk from different animals is usually mixed, so that the activity of the virus in virulent milk is in this way attenuated, by its commingling with healthy milk. This attenuation may be so great that the mixture is altogether inoffensive. Lastly, it should be recognised that the milk of every tuberculous cow is not fatally charged with the contagious principle of Tuberculosis; although we cannot deny that the milk of such cattle should be very infective if the disease is localised in the udder.

It results from the observations collected up to the present time, and from a consideration of the natural condition of things, that the dairies which supply milk warm from the cow, to be given directly to children, offer the greatest danger to the public health. In these establishments they do not rear the cows they employ, but buy them, always endeavouring to obtain those which yield most milk, and these they milk excessively. From these circumstances, it very often happens that the cows in these places are already tuberculous on their arrival, and it is the milk of such animals which is consumed in the manner alluded to—either warm or cold—by persons who, from their constitution, are predisposed to the influence of the infecting agent.

The danger we refer to has been recognised for a long time,

and attempts have been made to avert it by different means. In certain continental towns such establishments are only allowed on the understanding that the owners will submit them to a special surveillance exercised by the local police, over the production of milk. In other places, the local administration prescribes, without other preliminary, the control of existing dairies; while in others, finally, the necessary conditions for the production and sale of milk suited for infants and sick persons, are alone prescribed, and the principles according to which the control of the milk supply should be effected, in order that it may combine the conditions required in establishments for the treatment of patients by milk, are indicated. In the latter localities the authorities do not care whether or not their recommendations and indications are attended to, but they entrust the customs servants with an official recommendation to be given to the proprietors of those establishments who will submit to the authoritative instruction.

The following is a form of contract which we (Lydtin) have drawn up for the administration of the town of Karlsruhe; it embodies the principal precautions to be adopted with regard to milch cows in dairies. "Contract between Mr. . . . of the one part, and the Local Board of Health of . . . represented by the magistrate . . . of the other part. The Local Board of Health hereby controls the production and the sale of milk in Mr. . . . 's dairy. Mr. S. . . . on his part undertakes:—

"1. Only to provide milch cows of breeds which usually furnish good milk; more especially to employ cows which have had two to six calves, and not to keep older cows; to exclude all cows which lose condition, have dull coats, cough or nasal discharge, have swellings about the neck, prepectoral region, or between the thighs, lower part of chest or abdomen—tumours which are due to an alteration in the lymphatic glands or subcutaneous or dropsical infiltration; finally, not to have as milch cows those which exhibit symptoms of Nymphomania;

"2. To have the temperature of the milch cows taken in the rectum every day, so as to ascertain their state of health; to remove, on the advice of the veterinary surgeon, every milch cow whose temperature is above the normal standard (38.5° to 39°

Cent.), or which presents any other symptom of disease, and not to sell the milk of such animals without the permission of the veterinary surgeon ; not to sell for consumption the milk of newly-calved cows until fifteen days after calving, and provided the animals remain healthy during that time ;

“ 3. The cow-sheds to be kept well-ventilated and clean, and neither pigs, dogs, nor fowls to be kept in them ;

“ 4. To feed the cows conformably to the indications furnished by the Local Board of Health, excluding from their diet the residue of breweries, distilleries (grains), and kitchens, the leaves of root-crops, August-turnips, garden and field weeds, spoiled hay, and generally all damaged alimentary matters ; to give spring water to drink ; to cleanse from time to time by means of hot water or a solution of potash all the utensils out of which the cows receive their food or drink ; not to feed with green forage except with the sanction of the Local Board of Health ;

“ 5. To have written on a placard in a conspicuous part of the shed, the ration allowed by the Board for the milch cows ;

“ 6. Not to allow any sick person, or one who is recovering from an infectious disease, to interfere in any way with the milking of the cows, or in collecting, preserving, conveying, or selling the milk ;

“ 7. To keep all the vessels which hold the milk scrupulously clean ;

“ 8. Not to milk the cows, generally, except in the morning and evening, to measure the milk at each period, and enter the quantity on a card in the shed or dairy, and to inscribe it in a register *ad hoc* ;

“ 9. To mix the milk obtained from the healthy cows, find the specific weight of this mixture, and to register this also ;

“ 10. To cool rapidly all the milk which is not to be at once used naturally, or for butter or cheese, using a refrigerating machine ; not to add anything foreign to it ;

“ 11. In the production of milk from goats to apply the same procedure ;

“ 12. To permit access to all parts of the establishment concerned in milk production, of every member of the Board of Health.

“Mr. . . . engages, in addition, to conform to any special measures that the Board may consider necessary to prescribe.”

We do not know of a more efficacious means than that of the control of the health of the cows, and the collection, preservation, and sale of the milk. It may be added, however, that this control, which gives good results in certain cases, leaves something to be desired, with regard to its application, in the generality of dairies.

A minute inquiry into the ways and means of preserving mankind from the danger with which they are threatened by the employment of the milk and flesh of tuberculous cows, brings us to the conclusion that if the inspection of cattle intended for slaughter and those kept for milk production, even combined with that of the meat and milk offered for sale, does not afford security, in relation to the expense it involves, yet it cannot be ignored that it constitutes a useful, nay, a necessary measure.

The utility of this inspection of meat and control over the milk supply in countries where they are in force, is so great that the necessity for maintaining and improving these preventive measures cannot be doubted. But, nevertheless, an analysis of the facts and a consideration of the results obtained show, that this inspection and control are not sufficient to afford a sufficient guarantee to mankind against the real and undeniable danger of the possible transmission of Tuberculosis through the medium of the flesh and milk of phthisical cows ; neither does this control suffice to preserve the public wealth from the damage it sustains through this malady. We should therefore endeavour to find other means which may afford more efficient protection from the danger ; and it is this search for a real preservative which imposes a heavy and urgent task on the veterinary profession.

Since Villemin's discovery, veterinary surgeons have found themselves in a very difficult position, they being, as it were, between Scylla and Charybdis : urged, on the one hand, to completely exclude from public consumption the flesh of tuberculous cattle, which the progress of science has shown to be infective ; and solicited, on the other hand, not to sanction so radical a measure, as the instances in which human health has

suffered from its use must necessarily be very rare, and the danger proposed to be averted being yet but little appreciated by the great majority of the public, such a rigorous measure would not be approved. In dealing with such a question, we must reckon seriously with public opinion, as the measures necessary in this instance will gravely affect the interests of the butchers, as well as the breeders, feeders, and other owners of stock, and will demand considerable expenditure to ensure efficacious inspection of slaughter-houses and the sale of meat.

However, public opinion begins to be interested in this question. The conviction that the consumption of the flesh and milk of phthisical cattle constitutes a veritable danger, which conviction at present is only held by a portion of the public, is gradually penetrating society, and daily gaining ground. It will follow, therefore, that ere long a sure guarantee will be demanded from the State against the permanent danger incurred from this disease in bovines, and pressure will be brought to bear on public administrations to compel them to adopt the necessary measures. Unfortunately, in having recourse to the opinion of competent persons, governments will have to contend with the indecision of these, and stand before hesitating opinions ; consequently, they will give up attempting to devise measures, and throw upon the undecided scientists or practitioners the heavy responsibility of an eventual calamity.

The Sanitary Commission of Gotha expressed itself on this subject in the following terms : " With regard to the consumption of the flesh of tuberculous cattle, the Commission has not yet arrived at a definite opinion, for the reason that competent persons are not agreed, or are at least somewhat in doubt, as to this matter. It has been established as a fact that by the use of this flesh Tuberculosis may be transmitted ; it is not overlooked that the gastric juice does not always destroy the tubercle contagium, and that cooking is not a certain or sufficient procedure for the destruction of the virus, unless the flesh is kept for hours at the boiling point ; it is also known that a microscopical examination of the flesh, such as is made with trichinous flesh, allows the existence of the disease to be ascertained (?). Does it not seem, from all these circumstances, that there should be no doubt

as to whether such flesh is or is not admissible as human food? It is very singular that there should be any scruple in condemning this, merely because the prohibition of its use may somewhat damage the pecuniary interests of certain persons!"

Reproaches similar to the above will certainly be multiplied, if veterinary surgeons do not decide to frankly declare, without consideration for the interests they are not called upon to defend, that the flesh and milk of tuberculous animals should not be allowed for human food, and if they do not indicate the ways and means by which the necessary measures may be applied in a form satisfactory to the generality.

The Organising Committee of the International Veterinary Congress has recognised the urgency of a solution of this question, by including Tuberculosis among the *tractanda*. The Congress cannot refrain from the task of arriving at a practical solution of this question, if only *in nuce*; as the propositions which have already been put forward up to the present time are insufficient for the attainment of this object.

We have seen that the source of contagion in tuberculous animals can neither be completely diverted nor altogether exhausted, because the control of the flesh and milk supply is surrounded with so many insurmountable difficulties as soon as these articles are disposed for sale, and also because a permanent surveillance of cattle, with the concurrence of the owners, does not afford a guaranty commensurate with the gravity of the danger.

It remains, then, to inquire if the police measures applied to the contagious maladies might not furnish us with the means of completely drying up the sources of the disease; but in selecting these measures, we should not lose sight of the fact that it is more especially by the association of the private interests of the cattle-owner with the public interests—that is to say, with the willing assistance of all proprietors of stock—that we shall the more readily attain the proposed object.

In pursuing the latter course, we find ourselves at home; for we are placing ourselves in the real domain of veterinary medicine and veterinary sanitary police. In this domain contradictions and disputations are less to be feared, and they should not be so protracted as with sanitary police, properly speaking.

Tubercular Phthisis is, as has been already said, a disease which is transmissible by heredity and contagion; it is very prevalent among warm-blooded animals which live in proximity to man. No other malady so well merits the designation of *Universal Panzoöty*, or "World-plague" (*Weltseuche*).

It is demonstrated, on the one side, that this malady is only propagated by a well-determined contagium, elaborated by animals affected with it; on the other side, it is admitted in principle, in modern sanitary police laws, that the contagious diseases of our domesticated animals, when they are incurable and fatal, should be combated by isolation, slaughter, removal of the sick or suspected, as well as by the disinfection of the places occupied by these animals. In the presence of these two facts, we should no longer hesitate to adopt, with regard to this malady, analogous measures to those prescribed for these other contagious diseases. Some careful, experienced, and intelligent breeders have for years so acted, that instead of putting away tuberculous animals, so that they might no longer do mischief, they have sold them or sent them to the butcher; instead of diminishing the injurious influence of such animals, they have rather favoured it; they purified their own stables by infecting those of their neighbours.

There is no reason why Tuberculosis should not be included among the maladies which must be combated by sanitary police measures. The majority of farmers, by a careful and prolonged examination of their animals, are able to recognise the manifestations which denote the existence of this disease, or lead to suspicion of its presence; we might, therefore, render the *declaration* of this malady obligatory.

The veterinary surgeon can also, in the majority of cases, and during the life of the animal, recognise or suspect the existence of the affection. The diagnosis may, in every instance, be positively established when recourse is had to an autopsy. Besides, nearly all the sanitary police laws have provided for the slaughter and autopsy of suspected animals, with a view to the confirmation of the diagnosis in cases of epizoötic diseases. We might, therefore, in order to save time, get to know, in a given case, up to what point suspicions as to the existence of the disease are or are not justified.

As with Glanders, we should, when dealing with Tuberculosis, look for the appearance of new cases in cowsheds where one animal has shown symptoms of it ; these are most likely to be animals related to it by parentage, or standing beside it. It is therefore possible to recognise in good time the suspicious animals.

As soon as Tuberculosis has been recognised among the inhabitants of a cowshed, the suspected animals should be got rid of as soon as possible, and the stalls and other places cleansed and disinfected, as well as the utensils which have served to hold their food and drink, and the articles of grooming and equipment. It would even be desirable to disinfect the clothes of the persons who have been more or less in contact with the diseased or suspected animals.

If the number of cattle is considerable in a shed, a herd, or a farm, it would be best to remove from these places those which do not manifest any suspicious symptoms ; those affected, as well as those suspected, should be immediately sacrificed on the spot, or in an adjoining abattoir, or after being fattened for a few weeks. After getting rid of all the diseased or suspected, measures of cleansing and disinfection of the sheds, utensils, etc., should be resorted to.

In the introduction to the present work, we have shown that Tuberculosis is most frequent among bovines, that the other domestic animals, and especially pigs, are less disposed to contract the disease, and that they probably receive its germs through the intervention of affected cattle. As there is no need to apply such severe measures as in the cases in which we have to combat a grave disorder, we may limit their employment to the instances in which it is necessary to stamp out the disease in the *bovine species*, no matter in what form it appears. A limited application of the same measures may be made in cases in which the malady is developing in the other domestic animals capable of contracting it ; though it is to be observed that the extinction of the disorder among the bovines will probably lead to its disappearance in other animals. It would, however, be desirable that the local police authorities should have the right to apply measures analogous to those mentioned to the disease affecting

other than bovines (especially pigs), if it should extend and assume sufficient importance to justify them.

The flesh and milk of tuberculous animals, whatever may be the species of these, should not be allowed to be consumed as food, and any infraction of this prohibition should be punishable.

It is true that the application of the proposed measures, maintained until the disease had completely disappeared, would cause heavy loss to the breeders and feeders of stock. The farmers would, for this reason, endeavour to evade these measures, and this evasion would be all the easier from the chronic and occult nature of the disorder. Supposing that recourse be had to these measures, they would only have the desired effect if their application was supplemented by another arrangement, which is also resorted to in certain countries, and yields satisfactory results—this, is *awarding an indemnity* to the owners whose cattle are sacrificed. This award is perfectly justifiable in this instance. The cattle-owner, left to his own efforts, is not in a position to preserve his property from an invasion of Tuberculosis. If his stock is decimated by the malady, it is not he who has been knowingly the cause of the accident; so that, in compelling him to get rid of his animals without compensation, we are imposing on him a more or less heavy sacrifice for the benefit of all, so far as the preservation of the health of mankind and the public wealth is concerned; and if he has to submit to such a sacrifice for the general good, then it is the duty of society to repair the loss he sustains, either wholly or partially.

Compensation is the price which a community owes to an individual (the owner of cattle in this instance) for his share in the struggle against a general danger; it is this indemnity which combines and concentrates the efforts of isolated individuals and of society into one mode of action—two groups of forces, which, without this bond, would remain hostile to each other. The equity of these principles no one can contest.

Conformably with the general principles which ought to regulate the distribution of indemnities in case of losses from contagious maladies, a portion of the loss which he has incurred should fall upon the owner of the cattle, as one-third or one-

fourth. This is a means employed by society to ensure the vigilant and interested surveillance of the owner, for the preservation of his stock. Full compensation should not be awarded except for those animals which have been slaughtered and found free from disease on an autopsy being made; but in such an instance as that in which partial compensation is granted, the sum realised by the sale of the carcase should be deducted from the total amount. There would, therefore, be nothing more to pay for the slaughter of a healthy animal than the difference between the value of the flesh and the entire carcase on the one hand, and the price of the living animal on the other.

In order to prevent excessive demands, the maximum amount of compensation should be legally fixed, beyond which the indemnity should not go.

Looking to the insidious course sometimes assumed by diseases for which compensation is allowed, it is advisable to give it not only for animals which have died or been killed by order, in consequence of a regular declaration, but also for those sold to the butcher, and in which the disease has been found after slaughter. This latter measure at the same time constitutes an excellent means of preventing the sale of tuberculous animals. Compensation should in these cases be considered as a reward for allowing the disease to be discovered in carcases intended for food, and it constitutes a much better means of preventing the clandestine sale of such flesh than the most severe administrative control of the butcher's trade, with the slaughter and the more or less heavy penalties prescribed by law. The awarding of compensation fills up a *hiatus* which has remained up to the present time in the system of meat inspection, and the existence of which explains the insufficiency of the results hitherto obtained with respect to the flesh of tuberculous animals. It does not matter to whom compensation is made—whether to the butcher, the cattle-dealer, farmer, or grazier—it always has, as a consequence, the relieving of the competent expert from the solicitations of interested parties, and enables him to give an impartial judgment—all that the inspector should have in view when endeavouring to protect the health of the consumer.

The practice of seizure has been abandoned, after existing

for centuries past, and the reason for this, in our opinion, is to be found in the absence of compensation. Medical men, such as Heine, Graumann, and others, who in this matter were only acting for other particularly interested persons, have been followed by intelligent persons, who have gradually won over public opinion to their cause.

It is for this reason that, now-a-days, a number of veterinary surgeons cling to the idea that the flesh of tuberculous cattle is injurious, and yet cannot categorically express their opinion as to the necessity for excluding the flesh and milk of such animals from consumption.

The granting of compensation would, however, not of itself dissipate the arguments which the cattle-owners and butchers, inspired by their private interests, oppose to the application of a sanitary measure the utility of which is indisputable, but yet it would facilitate the inspection of meat in each particular case. Compensation would not only have the effect of revealing the greatest possible number of cases of Tuberculosis, but it would also allow the veterinary surgeon to certify to every one of these cases. The veterinary surgeon, who is alone competent, could then determine how far the flesh might be allowed for consumption, and would not be importuned in one or other sense; he could be sufficiently strict to reject as unfit for food the flesh which he might consider dangerous. If these measures were adopted, it would be seen that the cattle-owners would not seek to utilise the food admitted for consumption, and that the majority of the public would no longer buy the flesh of tuberculous cattle as good food.

With regard to the question as to what is the material loss caused by Tuberculosis, this may be differently looked at and differently decided.

If we consider that the measures which should preserve the inhabitants of a country from the injurious effects of some general noxious cause—and the disease under consideration comes under this head—devolve on the State, it appears beyond doubt that the State should take this loss in hand by awarding compensation to those whose claims to it are made good.

In those large States which are divided into provinces, dis-

tricts, etc., this charge might be imposed on counties and central administrations. If, on the contrary, it is taken into account that the flesh and milk sold by cattle-owners constitutes, in special instances, a real danger for the consumer ; that it is certainly the interest of these owners to take the necessary measures to protect their animals from this grave cause of incessant losses ; and that the compensation allowed them for cattle slaughtered because of the disease ; then we are naturally brought to the conclusion that the realisation of the funds for compensation should fall, in the first instance, upon these cattle-owners.

In fact, the first effect of the stamping out of Tuberculosis would be to free cattle-owners from a heavy burden, the getting rid of a danger to the public health being here only of secondary importance. Besides, it is only right that every owner should assist in the creation of a fund required to successfully combat panzoötic diseases, and to arrest or diminish their destructive influence as much as possible ; and they should also have a real interest in ensuring the prompt and thorough execution of the measures recognised as necessary to prevent the losses these maladies occasion.

In decreeing as obligatory on the proprietors of cattle, the adoption of the system of insurance against losses due to Tuberculosis, the State would fulfil all its obligations with regard to those whom it governs. It would then be necessary to combine into an Obligatory Insurance Association all the cattle-owners of a country, county, or district ; and if it were decided to extend compensation to the butchers, these also should participate in the contributions to, and advantages derived from, the Association.

In countries where warranty laws (*lois sur la redhibition*) exist, and where Tuberculosis is classed among the maladies recognised by these laws, the right to compensation may be extended to the butchers.

Obligatory insurance, such as we have suggested, would require an annual census of cattle. This is already obtained in the majority of the German States ; it is made annually by the local administrations on a day fixed for the purpose. The census return is

posted up for fourteen days after it has been completed, in order to give people who are interested the necessary time to correct any errors they may discover, and eventually to insert all the corrections deemed necessary. The returns are finally sent to the receivers of contributions, who collect the proportion each cattle-owner has to pay, according to the number of cattle he possesses.

By this means, in the Grand Duchy of Baden in 1879 and in 1881, there was collected a sum of five pfennigs for each head of cattle, in order to provide a fund to compensate for the losses caused in 1879, 1880, and 1881 by Contagious Pleuro-pneumonia and Anthrax.

There is no occasion to insist further on the details relative to the system of compensation proposed, because of the very diverse organisation of the different States, and the varied exigencies which are the consequences.

It should be observed, however, that if these measures cannot be introduced in a general and simultaneous manner, the countries which adopt them would be compelled to guarantee themselves against the others, by deciding that compensation would only be given to the cattle-owners who could prove that animals recognised as diseased had been in the country for at least a year.

The idea of combating Tuberculosis by sanitary police measures and by obligatory insurance, at one and the same time, is not new. The Central Committee of the Agricultural Society of the Grand Duchy of Baden, at its meeting in 1882, addressed a petition to the Government, with the view of obtaining permission to present to the Chambers the draft of a Bill, rendering it compulsory for all cattle-owners to establish a system of mutual insurance against the losses caused by this scourge.

In 1881 the Badenoise Veterinary Society, at its seventeenth general meeting, voted the following resolution: "The meeting is of opinion that it is urgently necessary to institute a mutual insurance association among stock-owners, because of the losses caused by diseases which are neither the consequences of grave hygienic neglect nor crass ignorance."

When the same subject was discussed at a meeting of the

Upper Chamber on May 16th, 1882, Count Von Berlichingen spoke as follows :—"The ninth point to which I desire to draw your attention has for its object an extension of the law with regard to veterinary sanitary police. I have observed with satisfaction, that within the last few years the Grand-Ducal Government of Baden has been more actively engaged in improving agriculture and assisting it in one way or another. The law on sanitary police more especially has had favourable consequences in this direction. As for ourselves, we have been for a long time seeking for means by which to avert ruin from the poor people who have the misfortune to lose their cattle ; for we know, from experience, that very often the loss of their animals has been the origin of ruinous debts to which the brave toilers have succumbed. If a farmer loses a cow he has to buy another, and he has frequently to borrow the money at heavy interest to pay for it, or obtain it on oppressive credit ; once in the hands of the usurer, his ruin is nearly always consummated. Our reflections on this subject have brought us to the conclusion that it would be useful, as has been already said, to institute by law, obligatory and reciprocal insurance among stock-owners, against all the accidents to which the domesticated animals are liable. The draft which was drawn up with this view was submitted to the agricultural societies of the different districts. Nearly every one of these gave a special opinion, but the majority were unfavourable to the establishment of compulsory assurance. We admit that a good number of arguments may be brought against such a project, and we do not wish to say all we now think of it.

"The idea will be realised, we doubt not, but such a conception must be well considered and discussed before the majority of the public will recognise how correct and just it is. In any case, the domain of the law of sanitary police should be enlarged, and I am convinced that the Minister of State, as well as our honourable reporter, will entertain the opinion I hold, that this law is not yet perfect. To prove this, I need only direct your attention to the tubercular disease and Tubercular Phthisis. I am firmly convinced that if the women in our towns knew the danger they incurred by pouring into their coffee milk

from a tuberculous cow, we should immediately be crushed beneath an avalanche of petitions. The well-established fact that the use of such milk may produce Tubercular Phthisis, amply justifies a panic of this kind. The large owner who possesses a considerable number of cattle, soon notices when one of these commences to be affected with Tuberculosis, and loses no time in getting rid of the lot ; these then pass from hand to hand, until at length they reach the small farmers, who, in buying them, think they have got good bargains ; but before long they find out their mistake in the damage, or even ruin, they have to submit to.

“In ordering the burial of unhealthy flesh, because of this disease, we preserve hundreds of people from disease, while the poor people whose property we have seized are the only sufferers—they receive no compensation. We should like to see an order that all animals affected with Tuberculosis be slaughtered and their flesh buried ; but we should also desire to see the owners indemnified for the loss imposed on them.

“We are, lastly, of opinion that an indemnity should even be given for all meat seized and buried ; in the present state of the law this is very often not accorded.

“I have confined myself to these few indications, in support of which it would be easy to show you numerous letters and complaints, but I do not wish to occupy your time with these.”

In the Grand Duchy of Baden it is not only sought to institute repressive measures against Tuberculosis, but the authorities are much occupied in studying the practical means wherewith to oppose it. The central bureau of the Agricultural Society has charged the veterinary surgeon of the country (*Landesthierarzt*) to calculate how much money it would require, in the way of contributions from the cattle-owners, to raise a sum sufficient to cover *all* the losses among cattle, resulting from necessary slaughter or natural death.

As the system we have proposed, in order to arrive at a practical solution of this question, is of general interest, but at the same time presents an altogether special interest with regard to the question, we shall here reproduce all the calculations to which we have had recourse with this object in view.

By this calculation we have endeavoured to ascertain :—

- (a) The number of cattle in the country ;
- (b) Their average value ;
- (c) The number of animals lost every year ;
- (d) The sum total of losses, and the average value of each animal sacrificed ;
- (e) The importance of the danger incurred by cattle in different parts of the country.

These primary questions being more or less exactly solved, it remains to find what tax would be required to be paid by the cattle-owners to create a fund from which all the damage sustained in the course of a year, from the loss of cattle and destruction of meat, might be covered. It would also be necessary to determine if there was any reason, if such a fund was instituted, to create a unique contribution of so much per head of cattle, as is done in assurance societies against epizootic diseases ; or to decree a differential tax, dependent on the real value of each animal, and the danger of loss inherent in the locality where the animal is kept. The first of these two alternatives appears to us the best, as it better facilitates the practical success of compulsory assurance, which would again considerably assist in its effects the mode of assurance already existing.

In order to respond to the above questions, we were compelled to depend upon facts collected during the course of several years, and obtained from the best sources.

The information of which we availed ourselves was derived from official sources, particularly from :—

(a) The publications of the statistical *bureau*, which give every year the result of the census of cattle (years 1867 to 1879).

(b) The annual reports of the district veterinary surgeons of the Grand Duchy of Baden (1872 to 1879) ; these documents are first submitted to the district administrations, then forwarded to the Minister of the Interior, who sends them to the technical reporter, who prepares a *résumé* of them.

(c) Special information obtained direct from the veterinary surgeons by the Minister of the Interior (1876 to 1879).

(d) The abstracts of prices of cattle sold at the markets, and

those of butchers' meat, published in the weekly agricultural journal and in official publications (1866 to 1879).

(e) The abstracts of excise, the amount of which is published annually by the general direction of contributions of the Grand Duchy of Baden (1832 to 1879).

(f) The abstracts prepared by the court of accountants, relative to the money paid as compensation by the Treasury for animals slaughtered by the police, or because of Contagious Pleuro-pneumonia or Anthrax (1879).

(g) The abstracts of accounts of several insurance societies against the losses in cattle in several parts of the country (several years between 1868 to 1879).

The *quantity* of this information is sufficient to allow of a sufficiently precise conclusion to be drawn, and to solve the questions asked above, as it belongs to a period during which numerous modifications and alterations occurred in the cattle trade. These modifications and alterations have been the cause of considerable variations in the numerical importance of the bovine population, in the value of each head of cattle, as well as in the mortality occurring among the cattle in the course of this somewhat long period.

With regard to the *quality* of this information, we believe—even without taking into account the value of the sources whence it has been derived—that it can be accepted with as much confidence as such information deserves. Notwithstanding the difference of the sources, the conclusions arrived at are in harmony; they are evidently rational, and not in opposition to the facts.

These preliminaries being established, we may proceed to examine the questions already propounded. The *first* is concerning *the importance of the bovine population* in the Grand Duchy of Baden. From an examination of the documents mentioned, the number of cattle has been :—

In 1872, 621,888 ;	In 1876, 568,046 ;
„ 1873, 660,405 ;	„ 1877, 590,158 ;
„ 1874, 654,846 ;	„ 1878, 648,732 ;
„ 1875, 626,026 ;	„ 1879, 665,729.

The annual average during this period has therefore been 629,435 cattle.

The *second* point is the *average value* of each head of cattle. To solve this question, it was at first necessary to establish the average price of cattle in different parts of the country; the highest and the lowest prices of calves, heifers, steers, cows, and oxen have been calculated, and then valued in lots of a hundred, made up in such a way as to represent, in the proportion between the number of different animals composing it, somewhat the proportions usually found in the entire bovine population. The value thus calculated gives the average price of one animal.

Among a hundred cattle in the Grand Duchy of Baden, there is an average of seven calves, twenty-three heifers or steers, fifty-one cows, ten bulls, and nine oxen.

To calculate the respective value of these animals, the average price of the following markets is taken: Messkirch, Donaueschiregen, de Bretten, Eppingen, Adelsheim, Schönau, Ettlingen, and Boxberg. The results are as follows:—

Cattle of Messkirch and Neighbourhood.

	Price of Animals.	Total Value of a Lot of 100 Cattle.	Total Average No. per cent.
Calves ...	40 to 120 marks*...	280 to 840 marks ...	7 calves
Heifers ...	200 „ 400 „ ...	4,600 „ 6,900 „ ...	23 heifers .
Cows ...	250 „ 400 „ ...	12,750 „ 20,400 „ ...	51 cows
Bulls ...	150 „ 400 „ ...	1,500 „ 4,000 „ ...	20 bulls
Oxen ...	400 „ 500 „ ...	3,600 „ 4,500 „ ...	9 oxen

22,730 to 36,640 marks. 100 cattle.

Maximum and minimum averages, 366 to 227 marks.

Average value of each animal, 297 marks.

Neckar Breed.

	Price of Animals.	Total Value of a Lot of 100 Cattle.	Total Average No. per cent.
Calves ...	30 to 35 marks ...	210 to 245 marks ...	7 calves
Heifers ...	200 „ 250 „ ...	4,600 „ 5,750 „ ...	23 heifers
Cows ...	150 „ 300 „ ...	7,650 „ 15,300 „ ...	51 cows
Bulls ...	250 „ 300 „ ...	2,500 „ 3,000 „ ...	10 bulls
Oxen ...	400 „ 500 „ ...	3,600 „ 4,500 „ ...	9 oxen

18,560 to 28,795 marks. 100 cattle.

Maximum and minimum averages, 287 to 185 marks.

Average value of each animal, 237 marks.

* The mark is equal to a shilling.

Baar Breed.

	Price of Animals.	Total value of a Lot of 100 Cattle.	Total average No. per cent.
Calves ...	30 to 60 marks ...	210 to 420 marks ...	7 calves
Heifers ...	200 „ 350 „ ...	4,600 „ 8,050 „ ...	23 heifers
Cows ...	200 „ 400 „ ...	10,200 „ 20,400 „ ...	51 cows
Bulls ...	150 „ 300 „ ...	1,500 „ 3,000 „ ...	10 bulls
Oxen ...	250 „ 500 „ ...	2,250 „ 4,500 „ ...	9 oxen
		18,760 to 36,370 marks	100 cattle

Maximum and minimum averages, 364 to 188 marks.

Average value of each animal, 267 marks.

Forest Breed.

	Price of Animals.	Total value of a Lot of 100 Cattle.	Total average No. of Animals.
Calves ...	... 20 marks ...	... 140 marks ...	7 calves
Heifers ...	... 120 „ ...	... 2,760 „ ...	23 heifers
Cows ...	... 150 „ ...	... 7,650 „ ...	51 cows
Bulls ...	... 180 „ ...	... 1,800 „ ...	10 bulls
Oxen ...	... 300 „ ...	... 2,700 „ ...	9 oxen
		15,050 marks	100 cattle

Average value of each animal, 151 marks.

Odenwald Breed.

	Price of Animals.	Total value of a Lot of 100 Cattle.	Total average No. of Animals.
Calves ...	... 18 marks ...	... 126 marks ...	7 calves
Heifers ...	... 120 „ ...	... 2,760 „ ...	23 heifers
Cows ...	... 140 „ ...	... 7,140 „ ...	51 cows
Bulls ...	... 170 „ ...	... 1,700 „ ...	10 bulls
Oxen ...	... 320 „ ...	... 2,880 „ ...	9 oxen
		14,606 marks	100 cattle

Average value of each animal, 146 marks.

Country Breed.

	Price of Animals.	Total value of a Lot of 100 Cattle.	Total average No. of Cattle.
Calves ...	25 to 30 marks ...	175 to 210 marks ...	7 calves
Heifers ...	130 „ 150 „ ...	2,990 „ 3,450 „ ...	23 heifers
Cows ...	150 „ 200 „ ...	7,650 „ 10,000 „ ...	51 cows
Bulls ...	150 „ 250 „ ...	1,500 „ 2,500 „ ...	10 bulls
Oxen ...	350 „ 450 „ ...	3,150 „ 4,050 „ ...	9 oxen
		15,465 to 20,410 marks	100 cattle

Maximum and minimum averages, 204 to 150 marks.

Average value of each animal, 180 marks.

The average value of an animal of improved breed is, for the breed of—

(a) Messkirch...	...	...	...	...	297 marks
(b) Neckar	...	...	...	...	237 „
(c) Baar	...	...	...	...	276 „

With regard to the indigenous breeds, the price for each animal is—

(a) The Forests	...	...	...	...	151 marks
(b) The Odenwald	...	...	...	...	146 „
(c) The country in general	...	...	...	...	180 „

The animals of the three country breeds therefore average about 215 marks each animal.

From the annual abstracts of the district veterinary surgeons, the total number of these common cattle is to the improved breeds as 3 to 2. The value of an animal, such as we have estimated it, is therefore perhaps 10 per cent. more than the real value ; for in our calculations the two groups have been reckoned as equal.

The prices of the animals estimated in these calculations have been compared with the prices at the Cattle Market of Mannheim, and they do not differ much ; in fact, the average price at this market is, for—

9 fat bullocks	...	3,546 marks, or 394 marks each		
55 lean bullocks	...	12,815	„	233 „ „
7 milch cows	...	1,988	„	284 „ „
29 calves	...	1,073	„	29 „ „
<hr/>		<hr/>		
100 cattle		19,422 marks		

We may therefore estimate the average price of each of these animals at 194 marks.

Taking for the basis of our calculations the information furnished by the local assurance associations provided with regular statutes, we find the average value of an animal to be 169 marks.

With regard to the compensation which has been paid to cattle-owners for animals slaughtered by the authorities, we find that the average assessment in estimating 159 animals slaughtered has been 198 marks.

In considering all the figures, we may admit that the average value of a bovine animal in the Grand Duchy of Baden is about 200 marks.

Theoretical calculations having given, as the average value, 215 marks, the Mannheim fairs value 194, the local assurances value 169 marks, and the estimate of animals slaughtered by order 198 marks, we may admit the average value to be $\frac{215+194+169+198}{4}$ or 194 marks.

The *third question* we have to solve is relative to the annual loss in cattle. The following is the information we have gathered :—

			Dead.			Killed.
In 1872	...	...	548	...	...	3,830 cattle
„ 1873	...	...	473	...	...	4,189 „
„ 1874	...	...	677	...	...	5,204 „
„ 1875	...	...	1,053	...	...	5,060 „
„ 1876	...	...	898	...	...	4,805 „
„ 1877	...	...	796	...	...	4,654 „
„ 1878	...	...	893	...	...	4,586 „
„ 1879	...	...	1,170	...	...	6,736 „
			<hr/>		<hr/>	
			Total 6,508		39,064 „	
			Annual average 814		4,883 „	

The yearly average of animals which died from 1872 to 1879, was 0·13 per cent. of the bovine population, and that of animals killed during the same lapse of time was 0·76 per cent., or a total of 0·13 + 0·76 or 0·89 per cent.

In making the same abstract from the information supplied by the assurance societies, we find the following figures :—

The annual average of cattle insured during the period between 1872 to 1879, was 91,818, the average loss being 1,317, or 1·4 per cent. yearly. Between this and the preceding abstract there is a difference of 0·51. This difference is perfectly explained by the fact, that it was more particularly the small farmers who insured their cattle; and these, being worked, were more exposed to accidents than cattle not so employed. So that there is more danger by 0·5 per cent. for working than for non-working cattle in the Grand Duchy of Baden.

The *fourth question* to solve is that of the amount of pecuniary loss caused by the mortality in cattle. According to the above calculations, the average value of each head of cattle in

the Grand Duchy of Baden is 200 marks. The skin is generally the only portion of an animal which has died naturally that may be utilised, and it has scarcely 4 per cent. of the total value of the carcase, and should, consequently, be estimated at 8 marks.

From the above calculations, it appears that in the time between 1872-1879, 814 cattle died, and the value of each being on the average 200 marks, we find that the total loss may be estimated at 162,800 marks per year. From this sum we may deduct 6,512 marks, or 4 per cent. saved in utilising the skins of these animals; thus leaving the average sum of 156,288 marks lost annually in animals which died in a natural manner. Twenty per cent. of those necessarily killed were, to judge from the reports of the meat inspectors, of value besides that of their skin, 4 per cent. of their total value. Of 50 per cent., parts estimated at about 40 per cent. of the total value of the carcase could be utilised; and of 30 per cent., about 60 per cent. of the total value could be realised as if the animal could be considered healthy.

In seeking to determine the annual damage in the Grand Duchy of Baden, through loss of cattle from disease or accidents terminating in death, we arrive at the following results:—

The average number of cattle necessarily killed being 4,883, and each being estimated at 200 marks, the 977, or 20 per cent. of these 4,883 animals, of which the skins only could be used, represent a value of 195,400 marks. The value of the skins being estimated at 4 per cent. of their total value, reduces this loss to 195,400—7,816, or 187,584 marks.			
The 50 per cent. of these 4,883, or 2,417 animals which can only be partially utilised, represent a value of 483,400 marks. The parts of the 2,417 animals which may be realised (40 per cent.) represent a value of 193,360 marks; so that there remains in the animals a deficit of 290,040 „			
The 30 per cent. of these 4,883 animals which remain represent a value of $1,450 \times 200 = 290,000$ marks. The realisable portions of these 1,438 animals, equivalent to 60 per cent., amounts to 174,000 marks. The deficit on the latter is therefore 116,000 „			
In recapitulation, the sum lost upon animals necessarily slaughtered may be valued, for the Grand Duchy of Baden, at $187,584 + 290,040 + 116,000 =$ 593,624 marks.			
The loss on animals dying from disease 156,288 „			
The total loss may therefore be estimated at 749,912 marks.			

The total value of all these animals, died or killed, is

$5,697 \times 200 = \dots \dots \dots 1,139,400$ marks.

The total loss on these animals would be $\dots \dots \dots 749,912$ „

The parts which may be utilised may be valued at

$1,121,800 - 743,216 = \dots \dots \dots 389,488$ marks.

The losses are therefore about 65.82 per cent., and the value of the parts realisable, 34.18 per cent. of that of the animals as they stand.

It would then be necessary to pay an average of about 132 marks for each head, allowing compensation equal to the entire value of the animal, the sum realised by the utilisation of the parts which have not been destroyed being deducted.

If we compare these figures with those furnished by the assurance associations, we arrive at the conclusion that, on the average, these pay 111 marks per head for cattle which have died or been killed, and a sum of 145,919 marks annually for the 1,317 cattle for which compensation is due.

In seeking to find, by analogous calculations, the rate paid in 1879 for cattle killed by order, because of epizootic diseases, almost the same result is arrived at.

The number of animals sacrificed in these conditions has been 159, 40 of which were affected with fatal maladies; in the remaining 119 the diseases did not assume this character. On the average, each of these might be valued at 198 marks. For those which died, the compensation paid by the State has been fixed at an average of 131 marks, a deduction being previously made of one-fifth of the value of the animal and of the sum realised by the sale of the useful parts of the carcass. With regard to the 119 head remaining, for which entire compensation is due, the State pays 99 marks per head, as a great part of the carcasses could be utilised.

If we actually add to the sum paid as compensation for each of the 40 cattle, the fifth of the value previously deducted, and subtract from the total loss the sum realised by the sale of the useful portions, we find that the real loss caused by this disease may be estimated at an average of 157 marks per head.

If we seek the average of compensation for these 159 animals, and take 100 as the basis for our calculations, we shall find that

of the latter number there were, in 1879, 80 compensation cases at 99 marks, and 20 at 157 marks. The average compensation for 100 cattle may therefore be estimated at $7,920 + 3,140 = 11,060$ marks, or 110 marks per head.

The total value of animals killed by order of the police was $139 \times 198 = 31,482$ marks, of which 54 per cent., or 17,083 marks, has been paid by the State as compensation; the remaining 46 per cent. representing the value of the useful parts of the carcase.

It is therefore established, that if we desire to compensate without any other deduction than that justified by the sum derived from the sale of parts of the carcase, we ought, according to the theoretical statements, pay 132 marks per head; taking the accounts of the assurance societies into reckoning, this amount should be reduced to 111 marks, and according to the administrative reports, to 110 marks.

If we fix on the 132 marks per head, we should estimate the total loss with the loss to be covered, in a round sum, at $132 \times 5,697 = 751,040$ marks; but if we wish to have recourse to obligatory assurance, we evidently should not pay the *total* value of the animal, and the compensation ought not in this case to amount to more than about 80 per cent., as a share of the loss should fall upon the owner, to keep him from being negligent in attending to his stock.

The total value of the animals dead or killed by order of the authorities, without any deduction, amounts to ...	1,139,400 marks
Twenty per cent. of this sum, equivalent to	227,880 „
	<hr/>
	Remaining 911,520 marks.
From the latter sum should be also deducted the value of the products derived from the carcasses, or 33·75 per cent.	389,400 „
	<hr/>
	Remaining 522,120 marks.

Divided among the bovine population of the country, these 522,120 marks represent an assessment of 85 pfennigs per head. There must be added to the 522,120 marks a sum of 10 marks for each animal dead or slaughtered, if, as is very probable, the expenses of the experts are to be paid by the assurance organisation. Ten marks for 5,697 head of cattle makes 56,970 marks, or 9 pfennigs for each bovine in the country, and this, added to

the 85 pfennigs allowed to cover the cost of compensation, raises the total annual premium to insure each head of cattle to 94 pfennigs.

In our calculations we have not taken into account the expense of collecting the premiums, as we have admitted that they should be collected by the receivers of contributions, who are paid for this service whenever money is gathered as indemnity for the losses caused by any epizootic malady; so that extending the assurances to all the losses among animals would not cause any increase in the pay of these functionaries.

To pay compensation for 159 cattle slaughtered by order of the authorities, the State would require to deduct previously the sum of 0.76 pfennig (less than a pfennig) per head of cattle. Supposing that this measure be extended to 5,697 or, in round numbers, to 6,000 cattle, there would be 28 pfennigs per head, or 37 to 38 pfennigs, including expenses.

In comparing these figures with those furnished by the assurance services, we arrive at the following conclusions:—

The annual average number of cattle insured by local societies from 1872 to 1879 was 91,818; of these the average yearly loss was 1,317, or 1.4 per cent.; and for each of the latter an average of 111 marks was paid. To cover the losses, then, it would require, in round figures, a contribution of 1 mark 60 pfennigs per head of cattle insured; and in adding to this a supplemental tax of 10 pfennigs for expenses, there is a contribution of 1 mark 70 pfennigs for each bovine.

According to the information furnished by the district veterinary surgeons in their reports, the premium which should be paid for assurance of each head of cattle should be 95 pfennigs. From this, and also from the facts elicited by the application of the law with regard to compensation for loss of animals, the amount to be levied to carry out the compensation services would be 38 pfennigs for each bovine; calculated according to the indications shown in the assurance societies' documents, this sum should be 1 mark 70 pfennigs.

In each of these three divisions is included the expense estimated at 10 per cent. per head.

The *fifth question* is relative to the importance of the losses, considered in the different districts of the country.

The minimum and the maximum of the losses, according to the information up to date, are respectively 0·3 and 1·2 per cent. So that between the two there is a wide difference, but in the majority of the districts the losses vary in the averages ; the extremes being only noted in four or five districts.

The value of the animals varies in analogous proportions in different districts. Considering the minimum rate of assurance premiums—whether 38 or 95 or 170 pfennigs per head be fixed upon—it is not convenient in an assurance society to have graduated premiums, by basing these on the differences in the gravity of the danger and the value of the animals.

The establishment of different premiums, according to the districts, does not appear to us to be justifiable, as it would be necessary in some parts to pay double the amount of assessment, because of the danger animals incur and their pecuniary value. In establishing compulsory assurance, we might accept the bases of the assurance laws of the Grand Duchy of Baden, promulgated January 30th, 1877, and March 6th, 1880.

The calculations we have made had in view *all* the losses in cattle, whether due to official or voluntary slaughter, because of disease, or from natural death. The losses which are occasioned by Tuberculosis constitute scarcely one-third of the total deaths ; we may, therefore, for the Grand Duchy of Baden at least, maintain that if compensation is only allowed for cases of Tuberculosis, the assurance premium would not exceed fifty pfennigs ; probably it would be less. And we should not lose sight of the fact, that after some years' experience of such a system of assurance, the assessments would gradually diminish, as by reducing the number of cattle affected with the disease we should also be diminishing its chances of propagation ; we should even abolish these chances altogether, as they depend upon the intervention of diseased animals.

If by the application of such a measure the malady would be considerably diminished in frequency, yet we could scarcely hope for its complete disappearance, as there would always remain the possibility of its transmission from mankind to animals.

These transmissions are, however, rare, and might in every case be prevented by proper measures of isolation applied to tuberculous persons.

As we have, in the introduction to this work and in the discussion of the first two questions, demonstrated that Tuberculosis is a hereditary and contagious affection, and to such an extent that no other panzoötic malady exceeds it in these two points; and as, in treating the third question, we have shown that the control and disinfection measures employed up to the present time do not give to mankind sufficient guarantees of protection against the danger of contamination by the flesh and milk of tuberculous animals, the Congress cannot, in our opinion, evade discussion of the question as to whether Tuberculosis ought, or ought not, to be classed among those diseases, the propagation of which should be combated by sanitary police measures.

If the meeting shares in our manner of looking at it, it will likewise approve, taking into account the incurability and the very frequent fatal termination of this malady, of our proposal to combat it by measures of sequestration, by the slaughter of diseased and suspected animals, as well as by the disinfection of infected places and articles.

The Congress also should agree with us in the awarding of compensation for animals affected with Tuberculosis, this compensation being likely, before everything else, to ensure the success of the other measures. And its utility is further enhanced by the fact, that the charge which its application entails, whether it falls on the treasury or cattle-owners, is very small, considering the great advantages to be derived from it.

In discussing the question relative to the injurious influence of the flesh and milk of animals affected with Tuberculosis, and in attempting to solve it, from an exclusively veterinary sanitary police point of view, the Congress will not exceed the limits of its attributes.

And in indicating the means whereby cattle may be preserved from the ever-increasing destructiveness of the scourge, the Congress will render an eminent service to all those persons who breed and trade in cattle and their products, and consequently

to agriculture in general. Even without solving the question as to the transmissibility of Tuberculosis from animals to mankind, it will contribute indirectly to preserve the human species from the noxious influence which the flesh and milk of tuberculous animals might exert upon it.

The solution of this question directly touches the domain of veterinary sanitary police, properly so-called, and that of sanitary police in particular. It furnishes a radical means of satisfying, at one and the same time, the owners of cattle and the consumers of flesh and milk—a means which, we do not doubt, will be unanimously approved.

The commission entrusted with the preparatory study of the question relative to Tuberculosis, proposes to the Congress the adoption of the following resolutions :—

1. Tuberculosis is a disease transmissible by heredity.
2. It is contagious.
3. It should be classed among the affections which should be combated by sanitary police measures.
4. The measures to which recourse should be had are the following :—

(a) Every owner of domestic animals should be compelled to report immediately to the police authorities every case of Tuberculosis, or the appearance of any symptom which may lead him to suspect its existence ; the affected or suspected animal should be so kept apart that it cannot transmit the affection. The same obligation is incumbent on any one who takes the place of the owner of cattle, whether in a dairy, herd, pasture, or elsewhere.

Reporting the disease should be also obligatory on veterinary surgeons or other persons who professionally treat the domestic animals, as well as on meat inspectors or others who, by business, have to do with the destruction, utilisation, or handling of carcases or the products of these, if before the intervention of the police, they discover the existence of Tuberculosis, or, by recognising its symptoms, suspect its presence.

b. The appearance of the affection should be made known publicly, and the infected locality or herd designated.

c. Suspected and diseased animals should be sequestered, and their slaughter ordered as a police measure. Animals

suspected of contamination should be kept isolated, unless they are few in number, in which case they should be slaughtered by order of the authorities. If the number is larger, they may be fattened and sent to the abattoir as soon as possible.

d. The stables or infected localities should be submitted to special police *surveillance* for a year, dating from the last case of disease. The sale of animals suspected of contamination should only be permitted if they are intended for immediate slaughter, and this operation should be attended to by a veterinary surgeon.

e. The place which had been occupied by a tuberculous animal should be cleansed and disinfected, and this should also be done when the malady has disappeared from closed stables or other localities in which diseased animals had been kept, and it should only be after disinfection that the police measures could be removed. During the existence of the panzoöty the stables should be kept properly ventilated.

f. In order that the flesh and viscera of an animal may be allowed for human consumption, the disease should be recognised (after slaughter) as only at its commencement, the lesions merely affecting a small part of the body, the lymphatic glands being still exempt from all traces of tubercles; or if tuberculous deposits are present, that these have not undergone softening; that the flesh presents all the characters of prime meat, and the general condition of the slaughtered animal was satisfactory at the moment of slaughter.

The flesh of tuberculous animals allowed to be sold as food, should be taken beyond the locality in which the animal has been slaughtered, and should not be sold at an ordinary butcher's stall.

Any quarter of meat, or any viscera showing tuberculous lesions or changes, as well as the flesh of any other animal in which, at the autopsy, there is evidence of more marked disease than is indicated above, should be spoiled for sale by sprinkling it with petroleum, and afterwards buried under the surveillance of the police, though the extraction of fat by boiling may be authorised. The inspection of every animal affected with Tuberculosis should be made by a veterinary surgeon, who alone shall judge as to whether the meat is fit for consumption.

g. The milk of diseased or suspected animals shall not be used

for human consumption, nor for that of certain animals, and its sale should be rigorously prohibited. The milk of animals suspected of contamination should only be consumed after being boiled.

h. An indemnity should be allowed, under certain reserves intended to prevent abuses, for cattle killed by order, in consequence of Tuberculosis, as well as for those which have died of the disease, and for those recognised as tuberculous after slaughter for food. The indemnity may be paid out of the public treasury, or by compulsory assurance organisations.

i. Infractions of the preventive and repressive measures should be punishable.

j. To protect the public health from the dangers by which it is threatened through the possible consumption of the flesh of tuberculous animals, or damaged or putrid meat, in every district a competent service for meat inspection should be instituted.

k. Establishments which are specially set apart to provide milk for sick people or infants, should be under permanent control, and have their milch cows submitted to the inspection of veterinary surgeons officially appointed.

In recommending to the Congress the adoption of these resolutions, we do not think we have exceeded the limits of the *necessary propositions*, if it is desired to get rid of the danger which has for a long time threatened the interests of cattle-owners, as well as the health of consumers, and is a real calamity.

(The foregoing report was, unfortunately, not brought on for discussion until the last day of the International Congress. Though the question of Tuberculosis was considered one of the most important, if not *the* most important, that could be examined at such a meeting, yet as it had been placed last on the list of subjects, and those which had preceded it had occupied so much time, there was at one period a proposition to defer its consideration until the next International Congress, to be held in Paris.

One speaker, in admitting that the question was not yet sufficiently ripe for discussion from a *scientific* point of view, thought

that, nevertheless, it might be examined in a *practical* sense, and insisted that the Congress should decide whether it was prudent to abstain from eating the flesh of tuberculous animals. Another speaker was of opinion that the question as to whether such flesh should be consumed as food was a purely medical one, and added that at the last Congress held in Germany a decision was not arrived at for this reason. A third speaker said it was not possible to temporise in such a matter. Lyons, of which he was a delegate at the Congress, was waiting for a decided opinion on this question. In a practical point of view, there could be distinguished a *generalised Tuberculosis* and a *localised Tuberculosis*; he wished to know what should be done in one and the other case.

The President suggested that there should be a solution of the question, and the following proposition was put forward:—
“Considering that it is indispensable that the Congress should give an opinion relative to Tuberculosis in connection with meat inspection, the undersigned demand that the Congress should declare that it is useful to fix the cases in which animals may be rejected or accepted as food for the public.”

Lydtin said that in the Grand Duchy of Baden, a law was sought for to regulate the measures necessary to deal with the disease, and that he and others had examined this important question. For centuries there had been regulations with regard to the malady. The flesh of diseased animals had been divided into three classes: Flesh of the first quality, which might be sold without restriction; flesh of the second quality, which could only be sold in certain places as low-priced meat; and flesh of the third quality, which was seized and buried. He referred to the diagnosis of the malady, and asserted that it was no more difficult than Glanders, especially when the latter was in an occult or latent form. The existence of Tuberculosis is easily ascertained in the dead animal, notwithstanding the numerous kinds of alterations it might present. Everywhere are found traces of the influence of a foreign agent which has produced lesions wherever it has been deposited. There is no absolute

characteristic of the disease ; but a recent and very important discovery has thrown great light on the question, and given us, it may be said, a *criterium* of Tuberculosis. The presence of particular germs, the *bacilli* of Koch, revealed by means of the microscope, will eventually decide the question in doubtful cases. The disease was very widespread, and everywhere it had assumed considerable proportions. The cause was heredity and contagion. Its contagiousness had been accepted, then denied, for many centuries, but experimentation had finally proved its infectious character. The virulent agent enters the organism by means of the lymphatic vessels, and is slowly propagated. The lesions caused by the tubercular germs are at first localised and, as it were, isolated in the neighbouring tissues ; then step by step they invade the organism ; at the same time the oldest lesions undergo successive transformations : at first they are in the condition of crude tubercles, then they become caseous, purulent, and cretaceous.

The generalisation of the lesions is slow, and several stages in their progress may often be remarked in the same carcase. Sometimes the tubercles are localised, and the flesh has a good appearance. There is nothing to prove that this flesh is hurtful to the consumer, no accident from its use having yet been reported. When the tubercles are diffused throughout the body, and the lymphatic channels are more or less involved, it may then be asserted that the flesh is dangerous, or at least unhealthy as food. In Germany it is classed among inferior flesh, sold apart as diseased meat, and the public are therefore warned against it. At other times there are purulent or caseous centres, softened tubercles ; and in this case the flesh should certainly be rejected, as also in those cases in which the disease is generalised, a large number of lymphatic glands are affected, or the carcase is in an emaciated condition, showing that nutrition had been profoundly altered during life. He proposed that paragraph *f* (resolution 4) of the report be adopted, so far as the consumption of the flesh of tuberculous animals is concerned.

M. BOULEY: The question now before us constitutes one of the greatest difficulties met with in practice. It is asked what the meat inspector should do with the carcase of a tuberculous animal. But it is a fact that Tubercu-

losis is a dangerous disease for animals, which may contract it not only by the respiratory passages, but also by digestive ingestion, as well as by inoculation in any part of the body. He referred to the Toussaint experiments, the results of which were startling. The virulent element did not exist in the tuberculous lesions only, but was present in all the tissues. The juice of the flesh of a tuberculous animal, even after being heated to 50° or 60°—the ordinary temperature of roast beef—was virulent to the ox, pig, cat, rabbit, etc., when given in a virulent or small dose; large doses were not necessary. In putting the question to its ultimate consequences, it was not necessary to establish degrees in Tuberculosis, as when it exists it renders the consumption of the flesh dangerous. He was convinced that Tuberculosis, no matter the degree to which it had attained objectively, should cause the rejection of the flesh; at the most it should only be utilised when well cooked. Human Tuberculosis is certainly contagious; this is a fact known to everybody. Transmission takes place principally from husband to wife, and perhaps kissing is one of the conditions of contagion, through the medium of infected saliva. Tuberculosis is too widespread at present; it affects one-fifth of the population. He considered that it was in the butcher's department that one of the principal causes of the large number of cases of this disease was to be sought; it is probable that infection occurred through the digestive organs, as in the laboratory experiments. In conclusion, he proposed the following amendment:—

“Tuberculosis being recognised, experimentally, as a malady transmissible through the digestive organs and by inoculation, the Congress declares that there is every reason to reject for human consumption the flesh of tuberculous animals, no matter to what extent these may be affected, nor what the apparent quality of the meat may be.”

He was of opinion that the owners should be compensated, and thought butchers should establish mutual assurance societies.

VAN HERTSEN: This speaker explained what had been done in Belgium with regard to this disease, and especially the procedure he had adopted at the Brussels abattoir, when he had to deal with tuberculous cattle. These measures had been in operation for a very long time. In 1869 he had made them known in a work presented to the Veterinary Society of the Eure and Seine, and which had received the prize of that society. At that period he had arrived at almost the same conclusions as those in the report. At Brussels all emaciated cattle are confiscated, as well as the carcase of every animal showing numerous generalised tubercles undergoing softening, caseation, or suppuration—which lead to the supposition that the whole of the organism is infected. When the lesions are serious and multiple, no matter what the quality of the meat may be, the carcase is always seized; but when the tubercles are localised and in the crude state, and the flesh is satisfactory from a nutritive point of view, it is allowed to be consumed.

This practice had been established since 1869. With regard to the danger arising from the consumption of unboiled milk, he referred to a work

he and Professor Degive had presented to the Belgium Academy of Medicine, and he dwelt more particularly upon the considerable frequency of tuberculous lesions in the udder of milch cows—a fact which he had made known in 1868, but which had not received any attention, not even from doctors or veterinary surgeons, and no measures had been devised; the Academy had risen without discussing the important hygienic question he had submitted to it.

WIRTZ proposed an amendment to the resolution, to the effect that instead of “only a small portion of the body; that the lymphatic glands show,” it should be “that a portion of the thoracic and abdominal viscera; that the lymphatic glands which do not form part of these organs,” etc.

VAN HERTSEN was of opinion that Tuberculosis may have invaded the lymphatic system at the commencement of the disease. For his own part, he had noticed that the gland situated between the first and second rib was tuberculous in eight out of ten cases, and so far as meat inspection is concerned this gland was of very great importance, as he had found it to be tuberculous without requiring to see the other viscera. It was of great assistance in distinguishing Tuberculosis from Contagious Pleuro-pneumonia in quarters of meat when the pleura had been removed; and for this reason he had designated it the inspector’s gland.

LYDTIN maintained the necessity for retaining the proposition of the report. His views differed but little from those of Bouley, and he believed that with the proposed system a large number of tuberculous cattle would be rejected for consumption. Bouley would allow the sale of certain kinds of flesh, provided that this should be well-cooked, and he thought this would be sufficient. He agreed with Bouley that butchers should establish mutual assurance societies, and cattle-owners should be compensated. Without compensation they could not be sufficiently rigorous.

BOULEY wished to submit his amendment to the vote of the Congress, with a view to establishing the principle, which, in his opinion, should be most rigorous and absolute. With regard to regulations, that was an affair of competent administration.

ROSSIGNOL proposed an amendment which he subsequently withdrew in favour of that of Bouley. It was to the effect that “every animal killed for food, which shows lesions of Tuberculosis, should be seized as absolutely unfit for consumption. The carcass should be immediately rendered unfit for food by means of petroleum, and treated with sulphuric acid, or submitted to prolonged boiling in the cauldron of a knacker.”

VAN HERTSEN proposed to remove from paragraph *f* the words “that the lymphatic glands are yet exempt from every lesion of Tuberculosis.”

The first part of the paragraph was accepted by twenty-five votes and fourteen abstentions. The second part obtained fifteen votes for and fourteen against, nine abstaining. As a consequence of this vote, the amendment of Wirtz and that of Van Hertsen were lost. Several members desired to put paragraph *g* to the vote.

ROSSIGNOL did not wish to be so rigorous as Lydtin ; he would not reject the milk of animals suspected of contamination ; consequently, he would have the last phrase in paragraph *g* suppressed.

BOULEY supported this proposal.

LYDTIN said it was only a recommendation ; he thought the milk should be boiled before it was consumed. He could not accept Rossignol's proposition.

The paragraph *g* thus modified was put to the vote and carried, with only five dissentients.

BOULEY demanded a vote on paragraph *h*, which he proposed to modify as follows :—" Compensation should be given for cattle in good condition, which, after slaughter for food, are found to be tuberculous."

ROSSIGNOL was in favour of compensation for animals in good condition intended only for food.

AERTS considered compensation as a just measure when slaughter was compulsory.

WEHENKEL said that as they were only discussing the seizure of meat unfit for consumption, and not of a measure which would wrong the owner in protecting the general welfare, he could not support the proposal to give compensation. It was a question of merchandise of bad quality, the use of which was to be prevented ; nothing more. The State should not intervene. Compensation should only be given in cases where a cattle-owner, for the general good, is deprived of the chance of curing his diseased animal (compulsory slaughter in order to prevent the spread of a disease), or when the legal sale of goods is interdicted for the general benefit ; but an indemnity ought not to be awarded when it is sought to prevent the unlawful sale of diseased meat.

LYDTIN took the same view as Wehenkel, as it was the one which was acted upon in the Grand Duchy of Baden.

As there was no further time to examine this subject, the discussion terminated, the following being a *résumé* of the resolutions adopted by the Congress with regard to it :—

In order that the flesh and viscera of the animal be allowed for consumption, the disease should only be in its earliest stage, the lesions confined to a small portion of the body, the lymphatic glands yet free from alteration of a tuberculous character, the tuberculous centres not softened, the meat healthy and of the first quality, and the general nutrition of the animal at the time of slaughter leaving nothing to be desired.

The flesh of tuberculous animals intended for food should not be conveyed beyond the locality in which slaughter has been effected, nor offered for sale at the stall of an ordinary butcher.

Every quarter of meat, and any viscera showing tuberculous lesions or transformations, as well as the flesh of every animal in which signs of more advanced tubercular infection are found than those above-mentioned, should be rendered unsaleable by sprinkling them with petroleum, and finally buried, under the surveillance of the police. The extraction of the tallow by boiling, as well as the sale of the skin, may be permitted.

The inspection of every animal affected with Tuberculosis should be made by a veterinary surgeon, who alone can judge whether the flesh may be consumed.

The milk of animals affected with, or suspected of Tuberculosis, should not be used for the food of man, nor yet of certain animals, and its sale should be rigorously prohibited.

In May, 1883, the first meeting of the National Veterinary Association of the United Kingdom was held in London, under the presidency of G. Fleming, LL.D., Principal Veterinary Surgeon to the Army, and President of the Royal College of Veterinary Surgeons, when Mr. Cox, Army Veterinary Department, read a paper on Tuberculosis. In this paper the writer dwelt more particularly upon its importance to the public health, and referred to the probability of its transmission from cattle to mankind. He said :—

“In submitting the following cases, it may be stated that they furnish no direct proof as to the communicability of this disease from the bovine to the human species. We grant this; but they left an impression on our minds which is unmistakably in favour of its correctness.

“*Case 1.*—A man in our neighbourhood was in the habit of buying all the ‘wasters’ he came across—in fact, created quite a trade. The milk in every case was used for food purposes. The consequence was that several members of the family were attacked with Phthisis, and died. This was discussed at the time as being a strange coincidence; but the pathology of Consumption not having the same light thrown upon it as it has now, the matter lapsed into oblivion.

“*Case 2.*—A cousin of my own was attacked with Phthisis. During the progress of the disease, it was discovered that two of the

three cows which her father possessed were suffering from Tuberculosis, one of which went off as a 'waster.' The girl in question likewise succumbed. As the milk from these cows formed her principal diet, it is not difficult to imagine that it was the means of generating the disease.

"*Case 3.*—Not within our recollection, but which was constantly repeated by the late Mr. W. Cox, M.R.C.V.S., was the case of the son of a farmer. A cow under treatment for Tuberculosis had sore teats, and was regularly milked by this youth, he having sore fingers. It is supposed that he became inoculated. At any rate, the cow died from the disease, and the farmer's son became seriously ill from glandular disease of the throat.

"These cases will probably be attributed to mere coincidences; but they are conclusive enough in our mind that there is imminent danger from the milk of tubercular cows. If this theory of milk contamination is correct, how and in what form is the virus conveyed? If the outcome of bacilli, is it in the form of spores? The dilution which in large dairies occurs from tubercular milk being mixed with other not similarly affected, may tend to render it, if not inoperative, at least less virulent in its power of producing disease. We have further to deal with constitution. In some persons the tubercular diathesis already exists, and only requires the slightest accident, as it were, to precipitate the disease."

In opening the discussion, the PRESIDENT said:—

I rise with very great pleasure to open the discussion upon the first major subject. This pleasure is due to two facts—firstly, that it is a subject which interests us, as veterinarians, because of its important bearing upon bovine health; and secondly, because the disease which it treats of threatens most seriously the public health. It is well known to you all that there are certain diseases originating in animals which are transmissible from one species of animal to another, and from animals to men. These are, I am sorry to say, increasing in number. They may have been in existence, perhaps, for all time; but our more perfect means of diagnosis, examination, and elucidation have enabled us to trace their nature; and diseases which at one time were considered non-contagious, are now recognised as extremely virulent. Such diseases are Rabies, Anthrax, Glanders, and others, which are due to parasites. We appear to be able to trace the disease we are discussing to very ancient times. Even as far back as the period of the Roman Empire, we find mention of a complaint which many believe to be the same

as that we are now considering. It was not, however, until about the end of last century that the ravages it committed drew the attention of French veterinarians, and since that time it has been well known as a fatal disease to bovines, supposed to be due to food, water, or local influences ; but its true nature was not, by the majority of writers, even suspected. It is only within the last few years that its contagious character has been ascertained. We find that in recent days the majority, if not the whole of those who have examined the matter most closely, agree as to the infectiousness of the disease. Looking at it from this point of view, we are bound to pronounce it one of the most serious maladies which affect animals, not simply because of its insidiousness and fatality, but from the fact of its being transmissible from the bovine to other species, and from animals to man. I think you could not have chosen for discussion a malady which has more important bearings upon the agricultural wealth of the country and upon the public health. I trust that we shall be able to arrive at some conclusion as to the best sanitary measures to be adopted to meet a disease which threatens to undermine, to a very considerable extent, the health of our bovine population, and to damage very seriously the sanitary condition of the community. Hitherto it has not been recognised as a malady for the Legislature to deal with, and, unfortunately, information which might have been obtained regarding it has not been procured. This disease has been proved to be due to the presence of an organism which has certain distinctive features which it communicates to the malady. Its transmissibility is placed beyond doubt by experiments in the pathological laboratory. This is demonstrated by the ingestion and inoculation of tuberculous matter, and by giving animals the flesh and milk of tuberculous cattle. There is no doubt that the serum of animals affected with Tuberculosis is virulent. It also spreads as Glanders would spread—that is to say, if an animal suffering from the complaint were removed from the shed where it was kept and a healthy animal placed there, the latter would probably become affected ; and the facts which point to this are becoming more frequent and marked. On the Continent, where the malady has been under observation for some time, veterinarians believe that it is infectious, in the ordinary way to which we apply the term. With regard to the human species, it is a matter of doubt among high authorities whether Phthisis or Tuberculosis is infectious. While I should not like to trench upon the domain of the practitioner in human medicine, I believe the disease to be infectious in the human species, although not so much so, perhaps, as in the bovine. It is infectious from the human species to animals, as proved by the inoculation of rabbits and other creatures from the human being, and it has been abundantly demonstrated that there is a close relationship between human and bovine Tuberculosis. I think if there is any difference it is in the bacillus, or perhaps in a modification in the bacillus when transferred from one species of animal to another. A great difficulty we meet with is that, while we can experiment upon animals to prove the transmissibility of the malady from

one to the other, we cannot do so with regard to the human species. Gentlemen, it has struck me that we sometimes waste human life, that we throw away very good opportunities for experiment by the way in which we dispose of our criminals. I think no better use could be made of those condemned to death, than by experimenting in this direction. We know that if animals be fed for a certain time with tuberculous matter serious changes will take place in their bodies, although they may appear to be in perfect health. I do not know whether the moralists of this country would tolerate such a procedure, but I do think that criminals who so far offend against society as to take human life should thus be made to make some amends to that society whose moral principles they have violated. I do trust that our legislators may find some means to solve this problem. We must remember that Consumption destroys one-sixth part of the human species, and that it, in conjunction with Syphilis, is more likely than any disease eventually to destroy the human race; so that no effort should be spared to prevent its spreading. On the Continent they have statistics to show what a fearful malady it is. If we knew fully the effect of Tuberculosis we should pronounce it to be a more serious matter than the lung plague. In the beginning of this century the number of cattle attacked with this disease in one province of France was estimated to be one in ten; and Wolff admits a proportion of fifteen per cent. in a district in Saxony. Perhaps one of the most serious features in connection with this disease is that, the higher we breed our animals the more they are subject to it, and I am afraid the result will be disastrous unless the matter is taken up by breeders, who should have their attention drawn to the necessity for having their cattle examined before breeding from them. In the bovine species the malady is rarely present in an acute form. This is a most dangerous feature, because an animal may appear to be in excellent health, give large quantities of milk, and show no symptoms of being affected with Tuberculosis until the disease has reached an advanced stage, and it is not until then that the veterinarian is called in, even if his advice is sought at all. I am afraid that very few—even of the most advanced—cases find their way to the knacker, but go to the butcher's stall instead. In this country the slaughter of cattle and the inspection of meat are in an extremely unsatisfactory condition. The dairies in many towns are a disgrace to us, as are also the slaughter-houses. In London, I believe, there are some hundreds of private slaughter-houses. Although there is an inspection, still it is of the most unsatisfactory character. An inspector is allotted to a district, in which there may be one hundred and fifty slaughter-houses, and anything more abominable than the condition of these can scarcely be conceived. The filth is extreme, and such unsanitary conditions in a city closely packed with human beings as London is, are a disgrace to the Corporation. Until we have our dairies and slaughter-houses inspected by skilled and competent men, and have our meat supply under proper control, we shall not be able to say that the public is secure against the invasion

of contagious diseases, due to infectious flesh. This is a question which must be brought before the public again and again until measures are adopted for effecting a reform. It is shocking that the poor people of our large towns should be exposed to this danger, because the carcasses of diseased animals are sold for human food. They are more likely to be affected by diseased food, and should, therefore, be more protected than the wealthy classes. We may well fancy that the great mortality which exists amongst the children of the poor can be, to a large extent, due to consuming the milk of cows suffering from Tuberculosis. I am overstepping my limits in the matter of time, but I wish to throw out a few hints for discussion, and looking at Tuberculosis as we know it, understanding its infectiousness and transmissibility, and knowing the certain fact that it is inoculable, I think that it should at once be taken under legislative control, and the manner in which this is to be done is easily prescribed. Place Tuberculosis under the Contagious Diseases (Animals) Act; have animals suffering from it destroyed; and give owners compensation, as is done in the case of Pleuro-pneumonia. That the disease is hereditary there can be no doubt, and this will doubtless account for its presence in young animals. I think I have said enough to draw forth discussion, and I trust that you will be ready to lay your views before the Privy Council.

Mr. COPE: I have ventured to address you at this early period of the debate with the object of suggesting that it would be most convenient if we were to confine our remarks to practical points in connection with this most important subject, rather than to consider its scientific aspects, which are at present in the hands of distinguished men, more capable of carrying out investigations. I think we might divide this subject into two heads—first, what measures can be taken in order to suppress this disease amongst animals; and, secondly, what steps shall be taken to prevent its transmission from animals to human beings. I hold that the first is especially a subject which comes within the province of the veterinary profession. If we cannot exactly say the same of the second, still it is evident that the public have a right to expect from us an expression of our views with regard to the prevention of the transmission of the disease from animals to man. The department to which I have the honour to belong is to be called the Department of Agriculture, and I trust that this name will meet with the approbation of the veterinary profession. It is an indication that Her Majesty's Government, having had in view the benefits which have been obtained from the formation of the Veterinary Department of the Privy Council, are willing to extend the operation of that Department to the benefit of the British public. On referring to the resolutions which Mr. Fleming proposes to put at the International Congress, I see that he proposes that this disease should be included in the list of contagious maladies. I should be pleased to see that such a course of action was taken. But before we take such a step as this it is well that we should thoroughly consider the subject. Have we sufficient evidence to prove that this malady

is transmitted from animal to animal in the same manner as Foot-and-mouth Disease and others mentioned in the Acts? I have examined all the laws in force on these subjects in every country in Europe, and in no country has any action been taken by the Legislature for suppressing this disease among animals. It therefore follows that the veterinarians in those countries who advise their various Governments have not yet arrived at a decision respecting the laws which regulate the spread of this disease, whether it is simply hereditary, or capable of being transmitted by the breath, or in any other way. The next resolution proposed to be put at the Brussels Congress is this: "That owners should be compelled to report to the authorities the occurrence of this malady amongst their stock." Now, gentlemen, this is undoubtedly the only means by which any disease can be effectually dealt with, but I very much fear that in this matter we shall receive the most determined opposition from owners of pedigree stock. It is well known to many of us, that some of the herds of high-bred shorthorns are literally reeking with this disease. Yet many of these animals are of such value, that it would be almost absurd to expect their owners to give notice of the existence of the malady, as it might mean little short of ruin to them. With regard to the third point: "That all diseased, or suspected animals, should be destroyed under Government supervision," I think that this should be done. I know of nothing more monstrous, than to allow obviously affected animals to be sold for human food, and yet those who visit our large markets know that nothing is more common than for them to be sold to small butchers, and cut up for sausages. With regard to the question of compensation, this could easily be met in the same manner as compensation is dealt with in the case of other diseases. Nothing can be more desirable, than that the inspection of dairies should be carried out. With reference to all the subjects I have just enumerated, I think it is most necessary that this meeting should give an expression of its views in a tangible form. This will be of very great assistance to the authorities in establishing some basis for legislation. The next subject is, the transmissibility of this disease from animals to the human species. You, Mr. President, are well aware that recently a discussion has taken place in Paris on this point, and it has been shown by M. Bouley that this disease is not only found to exist in the lung, but also in the muscular structure. Now, instead of, as has been suggested, allowing certain portions of an affected carcase to be consumed as human food, I think it would be more consistent to lay down a rule that, *if an animal should be found to be affected with Tuberculosis, no part of its carcase should be so consumed.* I will not detain you longer, gentlemen, but holding, as I do, a position under that department of the Government which has for its functions the suppression of the different diseases of animals, I thought it my duty to be present here, to hear an expression of your views.

Mr. OLVER: I had no intention of speaking on this subject, and should not have done so had not the country members been asked to give their

experience with regard to this disease, and its prevalence in their districts. In my district—the Midlands—I have no hesitation in saying that a large percentage of the animals there are affected with Tuberculosis, and that diseased meat is almost daily being carried into the large towns. As to the cause of the malady, I think it may often be traced to sewage matter. In my district a small river, full of sewage, happens to run through a fertile valley. This river is frequently flooded, and the sewage matter deposited upon the herbage around ; and there, more than anywhere else, I find Tuberculosis. In one dairy in that neighbourhood four, five, or six beasts have to be slaughtered annually. Some years ago, I made several *post-mortem* examinations of beasts that had grazed on this land, and in one case in particular the mammary gland was found to be full of tubercles. The cow had been regularly supplying milk to a large town. I think there can be no question that Tuberculosis is transmissible from the bovine to the human species, and that nothing can be more dangerous—especially to the infantile population—than tuberculous milk. I have no doubt whatever as to the hereditary nature of the disease. I think the inspection of dairies is of very great importance. I annually inspect 200 dairies. I see that they are properly drained and ventilated, but have no power over the animals, or I should often order the removal of those affected with Tuberculosis. The nearer we get to thickly populated districts the more diseased animals we find. I quite agree that no part of their carcasses should be used for food. Mr. Cox mentioned two or three cases where people have died from using the milk of tuberculous animals. I may say that I have known about the same number. It is hard to say positively that the milk killed them, but it looked very much like it.

Captain RUSSELL : I have much pleasure in endorsing the remarks that have been made with regard to Tuberculosis in cattle. I have many opportunities of coming across this disease. In Lincolnshire it prevails to a very large extent. I have frequently observed that, if a beast affected with the disease has been removed from a shed and another placed therein, afterwards it has become affected. I have made *post-mortem* examination of young calves a few weeks old, and found that Tuberculosis was present, and I believe that in Lincolnshire nine-tenths of the so-called *wasters* are affected with this disease. I cannot at present endorse the remarks of Mr. Olver as to sewage being a means of spreading the disease. We have a sewage-farm at Grantham, but it has only been established about three years. My experience is that Tuberculosis terminates the career of very many old dairy cows. The inspection in Lincolnshire is carried out by the police, and if they are in doubt the veterinary inspector is called in. I have known infants to die from drinking the milk of cows affected with Tuberculosis, and have also known cases where children have been suffering from diarrhoea, which has ceased when the milk was changed.

Professor WALLEY : This subject of Tuberculosis is one which has engaged my attention for a very long period. About twelve years ago I called

the attention of the Scottish Metropolitan Veterinary Medical Association to the very serious nature of this malady, and you will remember that I have written a book on the matter. Since that time I have brought it forward at a meeting of the North of England Veterinary Medical Association, so that I can in a certain sense claim a propriety in drawing attention to points connected with the disease. I wish, in the first place, to point out the remarkable fact that, notwithstanding the efforts of the veterinary profession within the past twelve or fourteen years to bring this subject before the public, and more particularly before the scientific world, it has been put aside. I may be wrong, but I consider that this is largely due to the fact that the medical profession is always slow to take anything in hand which is suggested by us. Had they in years gone by acted upon hints which we gave, this matter would, I believe, be now in a different position to what it is. This subject overlaps and intertwines to a certain extent the paper for discussion this afternoon. Perhaps it is as well that it should be so, as it will clear the ground for the resolution to be brought forward. Mr. President, there are several points in connection with this malady, which I think of paramount importance, not only to the profession, but to the whole human race. We little thought twelve or fourteen years ago that this disease would to-day be shown to be due to a *bacillus*. I do not myself put this bacillus so prominently forward as some people. I look upon these little organisms perhaps in a different light to most people, although I should not like you to think that I do not believe in such things. I think in trying to prevent the spread of a disease like this, we should deal with material things. You cannot attack these organisms and prevent the malady, but you can take away the sources which give rise to it. Another matter, drawn attention to in Mr. Cox's paper and in the meeting this morning, is the identity between human and animal Tuberculosis. I think this subject should be pretty well set at rest by what information has been collected up to the present. I endeavoured to explain my opinions with reference to it in the paper read before the Scottish Medical Association. I think it is identical. I think that the mere physical difference is no proof of a want of morphological identity. I am glad that the question of sewage has been noticed. Assuming that Tuberculosis is due to a germ, is there anything to preclude the possibility of that germ being carried through the medium of sewage? It may be rather a far-fetched idea, but we know the wonderful vitality of these germs. If this theory be correct, it points to the necessity for more careful dealing with sewage matter. In Mr. Olver's district it appears that the animals are allowed to graze on the sewage lands. In other districts—notably in Edinburgh—the sewage is discharged on the grass at certain periods. The grass is mown and carried off, and the sewage is not put on the land within a certain period of the time when the grass is cut; that is to say, it is put on immediately the first crop is removed, and no more until after the second crop is carried. Perhaps Mr. Olver lays a little too much stress upon the subject of sewage, and

does not give quite enough notice to the possibility of these animals he alluded to having contracted the disease by contagion. Mr. Cox again, on page 5 of his paper, alludes to the question of different breeds of animals. He says, "There are, however, certain families which evince a greater liability than others." You may have noticed some time ago a statement to the effect that the Ayrshire cattle introduced the disease into Sweden and Norway. Ayrshire cattle are dairy animals, and are not so frequently affected with the malady as many others. Some years ago I had a student from Sweden who told me that they never introduced Ayrshire cattle into Sweden without their exhibiting Tuberculosis, and he attributed it in a great measure to the climate. He said that herd after herd had been swept away by the disease in the course of a few months. I have never found the malady to be so common in Edinburgh as it is said to be on the Continent. I quite agree with Mr. Cope, that we should consider practical matters with reference to the prevention of the disease. I have urged upon my professional brethren the necessity for combining together in our efforts to get the Privy Council to grapple with this disease. Until this is done it will be a source of danger to the whole human race, and of loss to those whose livelihood is dependent upon their cattle. I presume that any of the propositions you have put here may be voted upon in this room. I agree with Mr. Cope that the owner of a valuable herd of shorthorns would hesitate before reporting an outbreak of disease. The question is, Should the few be considered when you have to deal with many? Is there to be one law for the rich and another for the poor? You deal with Foot-and-mouth Disease, Cattle Plague, Sheep Pox, etc., and why not do so with this? There is also a proposition about the infected parts of carcasses. At one time I had some doubt about condemning the carcass of an animal with only a few tuberculous nodules. You may examine a great many carcasses without finding evidence of *muscular* Tuberculosis. The only condition in which I have found it has been in the muscles of the larynx, etc. But we alter our opinions. I must confess that I now hold that every particle of the carcass of an animal which has suffered from Tuberculosis should be condemned. I go further, and say that the examinations should be made by a veterinary surgeon, and not left to uninstructed meat inspectors. Why should we, for the sake of a few carcasses, run the risk of propagating a disease like this? The fifth proposal says, "The milk of infected cattle should not be consumed, or if it must, it ought first to be boiled." If the milk ought to be destroyed, why boil it? You have no proof that you destroy the virus. Seeing that we often have to deal with Tuberculosis of the udder itself, and that the disease is propagated to calves by the ingestion of milk, I say that the milk should be destroyed. Besides, there is no necessity for this proposition if you condemn the animals themselves. I think it is a pity that the Legislature does not cause all dairies to be placed under the immediate supervision of veterinary surgeons. If I find an animal which I believe to be the subject of Tuberculosis, I can only advise the owner to get rid of it. I can do no more unless he sells the milk;

then I can prosecute him for selling diseased milk. I hope and trust that the outcome of this meeting will be to impress upon the Legislature, as far as we can, the importance of dealing with the matter.

Mr. MACKINDER : As a country practitioner, where this disease is prevalent, perhaps I may be allowed to say a few words. There is at Peterborough a sewage-farm let to a number of cowkeepers, but I am not aware that Tuberculosis is more common there than anywhere else. My opinion is that the malady is infectious, and should be placed under legislative control. We should have difficulty in getting owners to report outbreaks of disease if they are only to be compensated at the low rate allowed by the Contagious Diseases (Animals) Act, and veterinary inspectors may find themselves placed in an awkward position. I think there should be more dairy inspectors. In one district in my neighbourhood an auctioneer inspects the dairies. The sooner it is placed in more efficient hands the better.

Mr. SANTY : I should like to ask Captain Russell whether he considers that "Angle-berries" have any connection with Tuberculosis, or whether they arise from an abnormal condition of the capillaries of the skin? We have in Lincolnshire a disease distinguished by swelling and ulceration on the outside of the lower jaw, called "Wens." These may be cysts containing matter of various kinds, sometimes liquid, formed along the parotid glands and down the cheeks. Is this Tuberculosis? There are in Lincolnshire hundreds of cattle thus affected, which are killed and used for human food. I scarcely know how the Legislature could deal with this disease; it is so easily transmitted. No doubt there are different causes of Tuberculosis in different localities. Mr. Olver speaks of sewage as producing it. I believe that the whole of our shorthorn herds are more or less affected with the disease, and that it is to a great extent produced by in-and-in breeding.

Captain RUSSELL : What are called "Angle-berries" in Lincolnshire is essentially a disease of the serous membranes of the abdomen and thorax. I have a very strong suspicion that "Angle-berries" have a connection with Tuberculosis. I am certain that they are hereditary. I have often had occasion to observe this. In a shorthorn bull I had to remove an excrescence from the penis, and on almost every animal that was got by him I had to perform a similar operation. I think that "Wens" are of tuberculous origin; I find that a single blister is a very good remedy for these. It is common in Lincolnshire to use nitric acid.

Mr. CAMERON : There is no doubt that the disease is contagious. I have known cases where a cow has been ill with Tuberculosis, and servants who have been on the farm for several years have told me that their cows have generally died in the same way. With regard to dairies, I have found the same difficulty as Professor Walley pointed out, viz., that we can only use moral persuasion. We require power, so that we shall be able to order the destruction of diseased animals. As to condemning affected carcasses, I am afraid that if this were carried out too stringently the question would arise as to where the money was to come from for compensation. I think

that if we condemn in the worst cases it is as far as we can go. I find that dairy cows are more affected than others. As to obtaining the introduction of this malady into the Contagious Diseases (Animals) Act, there is no doubt that very strong evidence would have to be produced before Government would consent. I think that the British Veterinary Medical Associations should petition for it to be so included. It has occurred to me that some of the funds of the National Veterinary Association might be set aside for the purchase of diseased animals upon which public *post-mortem* examinations might be held, and the general community made better acquainted with the condition of affairs. By this means we might obtain a large amount of public opinion to bear upon the question.

Professor MCCALL: I had no intention of taking part in the discussion when I came here, but your President has asked me to do so. I think it will be merely a waste of time to discuss this subject too much in its strictly veterinary aspects. I propose to say a few words from the stockbreeders' point of view. Some may think that I am not justified in doing so; but allow me to say, gentlemen, that I have been a breeder of stock for about sixteen years, and have had from fifty to one hundred cows under my management. I am not an authority upon shorthorns, and after what I have heard at this meeting I have no desire to be so. I can, however, say that Tuberculosis is an exceptional disease amongst the Ayrshire breed of cattle. There seems to be some difficulty in understanding this subject of Tuberculosis. Are we to look upon a "tubercle" as indicative of Tuberculosis? Because, in that case, I think there are very few animals exempt from the disease. A large percentage of animals present one or more of these little bodies, but may it not be that they are not always indicative of Tuberculosis? Experiments have proved that certain hygienic conditions produce Tuberculosis. The most recent experiments have proved that setons are not likely to cause the disease; but it was not always thought so. I have all the dairies, slaughter-houses, and markets in Glasgow under my charge, and have ample opportunities for seeing this disease. In the dairies of Glasgow the malady is very common. Cattle, if left in the fields, would be exempt from Tuberculosis and live to an old age; when brought into a city they become affected with the disease. How is this? If Tuberculosis is hereditary, then it is to be presumed that it does not develop itself in the Ayrshire breed of cattle so long as you leave them to roam in the pastures; but as soon as you bring them into the city and feed them on stimulating food, they fall victims to Tuberculosis. I do not believe that *all tubercles* are expressive of Tuberculosis. I see animals affected with the malady standing about the markets of Glasgow, but have no power to deal with them. We must look to Mr. Cope and other gentlemen associated with him in the Veterinary Department of the Privy Council, to obtain for us the power to meet these cases. Until I see more evidence, I will not believe that every animal which shows, upon *post-mortem* examination, the presence of tubercles is affected with Tuberculosis. Until this is settled, I think that we should be very careful in what

we suggest should be done by the authorities. I have seen bullocks in the markets in which you could detect nothing amiss, but when they were killed many tubercles were found.

Mr. HOPKIN : I can from my own experience endorse what Professor McCall has said. It does not matter whether we bring shorthorns or Ayrshires to town. In six or seven months they become affected with tubercles. If this disease is transmitted to the human species through the flesh of affected animals, then all the poor people in our towns ought to be suffering from Tuberculosis. I think those who know anything about our large towns will bear me out when I say that there is scarcely a home in them in which meat so affected is not eaten weekly. I do not know whether Tuberculosis is much more common amongst the children of the towns than of the country. We must not however overlook the fact, that the latter live under more favourable conditions than the former. Even if it is so transmissible by food, it is very slowly and insidiously developed. With regard to hereditary Tuberculosis, it may be twenty years before it shows itself. With some families the children show a tendency to it at certain ages. If we feed children on diseased meat will it produce Tuberculosis now or ten years hence? I had an assistant who came to me from one of the islands on the coast of Scotland. The family from which he came was healthy and strong, but when two of his sisters were young, their herd became infected with Tuberculosis. These girls were fed upon milk from the cattle. The two brothers, who were more fond of whisky than milk, are still hale and healthy ; the sisters are lying in their graves, victims to Tuberculosis. With regard to the inspection of animals, it is certainly most unsatisfactory. I think it ought not to be left in the hands of the local practitioner, who has his clients to consider. We have recently read that many of the tribes in Africa have no cattle, and that others possess large herds. I should like to ascertain whether Tuberculosis is known in Africa, and, if so, whether it is more prevalent amongst the tribes possessing cattle than among those who do not.

Mr. WILSON : I just rise to say a few words with respect to these miliary tumours. Are they associated with Tuberculosis? I have had a good deal of experience in connection with this disease. I remember the case of a cow which gave birth to two calves, both of which died of Tuberculosis. Shortly afterwards the cow was killed, and the whole of the interior of her peritoneum was covered with these small tumours. I believe Lord George Hamilton asked a question in the House as to whether, considering that Tuberculosis was now becoming so prevalent, and was known to be transmissible from animals to men, the Government would take some steps to place it under the Contagious Diseases (Animals) Act. I believe also that Mr. Mundella stated that the Privy Council had the subject before them, and intended to bring in a short Bill to place the Disease under the influence of that Act. If this were done power would be given to have diseased animals killed. If the Privy Council would order that the local authorities should cause dairies to be inspected by a properly qualified inspector, and reported thereon two or

three times a year, we should have a very different state of things to what we have now. As it is, the order says that the local authority *may*, instead of saying that they *shall*.

Mr. FLEMING : I will ask my own permission to speak again, in order to address you on one or two points with regard to the suggestions for discussion at the International Veterinary Congress to be held at Brussels in September next. At first, I should like to express the regret I experience that the medical profession in this country has not favoured the veterinary profession with a little more attention in this matter of Tuberculosis. I think that in a question like this, which so largely concerns the public health, it should have assisted us to arrive at some conclusion with regard to the best means of grappling with such a terrible disease. I do not claim absolute priority, but in 1873-4 I was so deeply impressed with the necessity for drawing attention to the malady, that I published a somewhat lengthy paper in the *British and Foreign Medico-Chirurgical Review*, basing my opinions upon investigations which were then going on, and especially on the trustworthy experiments of our lately deceased colleague, Professor Gerlach, of the Berlin Veterinary School, who demonstrated that this malady was transmissible by inoculation, by the ingestion of the flesh, and feeding with the milk of diseased animals. These experiments appeared to me to be such conclusive proof of the extreme danger to which the public was exposed, that I was astonished to find that what I had written fell absolutely without effect on the medical profession. It was not until the recent meeting of the International Medical Congress that the medical profession took up the question, and the reason of their doing so then was because certain medical men on the Continent were drawing attention to it. I am quite certain that if the medical profession would combine with us, we could, by our united efforts, bring so much pressure to bear upon our Legislature that the malady would be very much circumscribed in a few years. I make these remarks not in an ungenerous spirit, because I am aware that the medical profession in this country is not a whit behind that on the Continent, and that it can boast of possessing some of the brightest ornaments in the domain of medicine. With regard to the suggestion of reporting by owners, this is, of course, one of the chief means by which you can ascertain the existence of the malady. Tuberculosis is a most difficult disease to diagnose, and one is astonished to find in the slaughter-houses the carcasses of animals extremely infected, so that the reporting must be taken with a large amount of reservation. I think it would be better if the veterinary surgeon reported, but if he did so it is very likely that his client would not give him his patronage again. I think that the veterinary surgeon should notify the existence of the disease to the owner, and leave with him the onus of reporting the case to the authorities. I do attach much importance to the opposition which this compulsory reporting would provoke. The value of certain herds of shorthorns is very great. So are studs of thoroughbred horses. When an outbreak of Glanders takes place in one of the latter, does the Privy Council listen to the

objections of the owner? I think not. The spread of Tuberculosis will cause a thousand times more damage than the value of these cattle. With regard to the destruction of certain portions only of the carcasses of diseased animals, we must remember that the laws of different countries vary. The suggestions which are alluded to are merely for discussion at the Congress. I think that every portion of an animal affected with Tuberculosis should be destroyed. The idea that setons produce Tuberculosis has been proved to be an error. We find nodules in animals, as sheep, which are not at all liable to attacks of Tuberculosis. I maintain that no matter what the nature of the nodule may be, if the bacillus is found, it may safely be concluded that it is a case of Tuberculosis. I hold Tuberculosis to be this, that apart from the physical character of the nodule or tubercle, it is an inoculable disease. I think that is the great diagnostic criterium of Tuberculosis. The tubercle is only an expression of a diseased condition. I am very glad that the propositions for the Congress were incorporated in Mr. Cox's paper, because I shall have the advantage of knowing the opinion of this meeting with regard to them. Although the malady is not taken under legislative control on the Continent, yet there is a general impression that it ought to be; therefore it has been made one of the major subjects for discussion at the International Congress. I do not attach much importance to the theory with regard to sewage. Of course the germs of Tuberculosis may be carried through the medium of sewage, but as we find the disease prevalent where there is no sewage, we should not lay much stress upon this point. We cannot separate without coming to some definite conclusion with respect to the subject of this morning's discussion. We have here, in Mr. Cope, an able representative of the Veterinary Department of the Privy Council, and I am sure that any decision we may arrive at will be utilized to the fullest extent by him.

The following resolution was then put to the meeting, and carried unanimously, "That in the opinion of this meeting, the Privy Council should include 'Tuberculosis' in the Contagious Diseases (Animals) Act."

Some discussion then took place with reference to the question of compensation. Some gentlemen expressed an opinion that owners of cattle could not be expected to have their animals slaughtered merely for the benefit of the community. The President said he thought that the question of compensation, as well as all other regulations required to eradicate this disease, should be left to the Veterinary Department of the Privy Council, and that, if the regulations at present in force, with regard to compulsory slaughter, were applied in this case the public would be satisfied.

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